Contents

CHAPTER		Page	
1	SYNOPSIS	1	1/A9
	System effectiveness issues	3	1/A12
	Program acquisition issues	7	1/B2
	Potential impact of our recommendations	12	1/B7
2	ARMY PROGRAMS	15	1/B11
	Potential of LoAD Ballistic Missile Defense System for protecting the MX system	16	1/B12
	Issues concerning development of ballistic missile defense systems	21	1/C3
	Problems affecting the procurement and operation of the Army's AH-64 attack helicopter and associated systems	24	1/C6
	The Army's Standoff Target Acquisition System--a program having development difficulties	28	1/C10
	Future procurements of the Army's Copperhead projectile should be contingent on improvements in performance and reliability	31	1/C13
3	NAVY PROGRAMS	35	1/D3
	The Navy's lightweight torpedo: a new weapon that faces many development challenges	36	1/D4
	The Light Airborne Multi-Purpose System, LAMPS MK III, progress evident but some problems and questions remain	39	1/D7
	Opportunities for improving management of the Navy's Aegis Cruiser	43	1/D11
	Issues affecting the Navy's Anti-Ship Cruise Missiles	47	1/E1
	F/A-18 Naval Strike Fighter: progress has been made but problems and concerns continue	51	1/E5
4	AIR FORCE PROGRAMS	55	1/E9
	The MX Weapon System: issues and challenges	56	1/E10

Page

CHAPTER

4 DOD participation in the Space Transportation System: status and issues 59 1/E13
The F-16 Program: progress, concerns, and uncertainties 63 1/F3
The Department of Defense should resolve certain issues concerning the C-X aircraft before requesting proposals from industry for its full-scale engineering development 67 1/F7
Major issues concerning the C-X range and payload remain unresolved 72 1/F12
The Department of Defense should resolve major issues regarding reengining the KC-135 aircraft before continuing the program 78 1/G4
U.S. participation in the United Kingdom's development of JP-233--a costly deviation from acquisition policy 83 1/G9

5 JOINT PROGRAMS 89 2/A3
Some Land Attack Cruise Missiles Acquisition Programs need to be slowed down 90 2/A4
Review of the High Speed Anti-Radiation Missile Program 95 2/A9
Progress and problems of the Advanced Medium Range Air-to-Air Missile Program 99 2/A13
Decisions to be made in charting DOD's Assault Breaker 104 2/B4
Most critical testing still lies ahead for missiles in Theater Nuclear Modernization Program 109 2/B9
Review of Air Force's Next Generation Trainer Aircraft Program 116 2/C2
Air Force and Navy plans to acquire trainer aircraft 119 2/C5

APPENDIX

I Listing of other related reports issued from March 7, 1980, through March 31, 1981 125 2/C11

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BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Acquiring Weapon Systems In A Period Of Rising Expenditures: Implications For Defense Management

The planned rapid growth in defense expenditures in the next few years makes it especially important for the Department of Defense to exercise tight control over the development and acquisition of weapon systems. In a series of 24 reports, GAO has identified a number of problems in weapon systems development. Adoption of GAO's recommendations would help to

- minimize risks and ensure system effectiveness,
- improve disclosure of information to the Congress,
- ensure that weapon systems meet mission requirements,
- evaluate alternatives, and
- reduce costs.

Considering the high cost and complexity of modern weaponry, the Department of Defense must ensure that its weapon systems will be effective in planned missions.

UNITED STATES GENERAL ACCOUNTING OFFICE

MASAD-81-26
MAY 14, 1981

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-198192

To the President of the Senate and the
Speaker of the House of Representatives

This report summarizes the 24 reports we issued on major weapon systems from September 1980 through April 1981. We have highlighted the principal issues that we found to be common among the selected weapon programs and briefly summarized the potential impact our recommendations could have on those programs. The report also serves as a quick reference to all our major acquisition work on weapon programs since March 1980.

Our annual major weapon system reports to the Congress have proven in the past to be a useful method of providing information on programs for which funding is requested. We hope this consolidated report will again be helpful in your deliberations.

We are sending copies of this report to the Director, Office of Management and Budget, and the Secretary of Defense.

Milton J. Socolar
Acting Comptroller General
of the United States

Contents

CHAPTER		Page
1	SYNOPSIS	1
	System effectiveness issues	3
	Program acquisition issues	7
	Potential impact of our recommendations	12
2	ARMY PROGRAMS	15
	Potential of LoAD Ballistic Missile Defense System for protecting the MX system	16
	Issues concerning development of ballistic missile defense systems	21
	Problems affecting the procurement and operation of the Army's AH-64 attack helicopter and associated systems	24
	The Army's Standoff Target Acquisition System--a program having development difficulties	28
	Future procurements of the Army's Copperhead projectile should be contingent on improvements in performance and reliability	31
3	NAVY PROGRAMS	35
	The Navy's lightweight torpedo: a new weapon that faces many development challenges	36
	The Light Airborne Multi-Purpose System, LAMPS MK III, progress evident but some problems and questions remain	39
	Opportunities for improving management of the Navy's Aegis Cruiser	43
	Issues affecting the Navy's Anti-Ship Cruise Missiles	47
	F/A-18 Naval Strike Fighter: progress has been made but problems and concerns continue	51
4	AIR FORCE PROGRAMS	55
	The MX Weapon System: issues and challenges	56

Page

CHAPTER

4 DOD participation in the Space Transportation System: status and issues 59
The F-16 Program: progress, concerns, and uncertainties 63
The Department of Defense should resolve certain issues concerning the C-X aircraft before requesting proposals from industry for its full-scale engineering development 67
Major issues concerning the C-X range and payload remain unresolved 72
The Department of Defense should resolve major issues regarding reengining the KC-135 aircraft before continuing the program 78
U.S. participation in the United Kingdom's development of JP-233--a costly deviation from acquisition policy 83

5 JOINT PROGRAMS 89
Some Land Attack Cruise Missiles Acquisition Programs need to be slowed down 90
Review of the High Speed Anti-Radiation Missile Program 95
Progress and problems of the Advanced Medium Range Air-to-Air Missile Program 99
Decisions to be made in charting DOD's Assault Breaker 104
Most critical testing still lies ahead for missiles in Theater Nuclear Modernization Program 109
Review of Air Force's Next Generation Trainer Aircraft Program 116
Air Force and Navy plans to acquire trainer aircraft 119

APPENDIX

I Listing of other related reports issued from March 7, 1980, through March 31, 1981 125

ABBREVIATIONS

LAMPS	Light Airborne Multi-Purpose System
LoAD	Low-Altitude Ballistic Missile Defense System
SOTAS	Standoff Target Acquisition System

CHAPTER 1

SYNOPSIS

Proposed military budget increases for fiscal year 1982 and future growth projections for the next few years should greatly enhance the ability of the Department of Defense to acquire and modernize its major weapon systems. However, considering the high cost and complexity of modern weaponry, careful evaluation must be given to the issues disclosed each year about these weapon programs to avoid wasting significant resources on inadequate and/or potentially unnecessary equipment. Our annual reviews of selected weapon systems provide the Congress with information on many of these program issues as well as recommendations for addressing problems and reducing costs.

Since our last consolidated report (PSAD-80-43, June 12, 1980), our work on weapon systems has culminated in 24 reports on 28 selected systems. 1/ These reports were issued to the Congress, committee chairmen, and the Secretary of Defense from September 1980 through April 1981.

Our reports identify 81 issues, falling into 14 categories, which either have a direct bearing on the weapon systems' effectiveness or on the management of the acquisition program. These issues, summarized below and displayed in a matrix on page 2, are not intended to represent all of the problems or questions associated with the weapon programs reviewed. The issue categories should also not be considered independently because some of the categories are very closely related. Each issue may become more or less serious over time depending on where it occurs in the acquisition cycle and how the Department of Defense chooses to address it. More information on the issues is contained in the summaries in chapters 2 through 5.

An addition to this year's report is the inclusion of a matrix and narrative on pages 12 through 14 summarizing the potential impacts we believe our recommendations would have on the reviewed programs if acted upon. These include opportunities to minimize risks, ensure system effectiveness, improve disclosure of information to the Congress, affirm system requirements, evaluate alternatives, and reduce costs.

1/Includes the Space Transportation System which while not a weapon system will serve defense needs.

ISSUES ASSOCIATED WITH SELECTED MAJOR WEAPON SYSTEM PROGRAMS

B3

	SYSTEM EFFECTIVENESS						PROGRAM ACQUISITION							
	OPERATIONAL REQUIREMENTS	FORCE LEVEL/ MIX REQUIREMENTS	OPERATIONAL/ PERFORMANCE LIMITATIONS	SURVIVABILITY/ VULNERABILITY	RELIABILITY/ MAINTAINABILITY	LOGISTICS SUPPORT	TECHNICAL RISKS	ADEQUACY OF TESTING	A-109 INCONSISTENCIES	AFFORDABILITY	PROGRAM CONCURRENCY	COST EFFECTIVENESS	PROGRAM MANAGEMENT	TIMELINESS
ARMY PROGRAMS														
LoAD BALLISTIC MISSILE DEFENSE	X		X	X			X					X		
AH-64 ATTACK HELICOPTER			X	X			X			X				
STANDOFF TARGET ACQUISITION SYSTEM		X		X	X			X			X		X	
COPPERHEAD PROJECTILE			X		X									
NAVY PROGRAMS														
ADVANCED LIGHTWEIGHT TORPEDO			X		X		X							
LIGHT AIRBORNE MULTI-PURPOSE SYSTEM		X	X	X	X									
AEGIS/CG-47						X		X						
ANTISHIP CRUISE MISSILE PROGRAMS	X	X	X						X					
F/A-18 AIRCRAFT			X		X		X			X				
AIR FORCE PROGRAMS														
MX WEAPON SYSTEM	X	X		X		X								
SPACE TRANSPORTATION SYSTEM				X		X	X							
F-16 AIRCRAFT		X	X		X	X			X	X				
C-X AIRCRAFT	X								X					
KC-135 AIRCRAFT MODIFICATIONS	X									X		X		X
JP-233 AIRFIELD ATTACK SYSTEM	X		X					X						
JOINT PROGRAMS														
LAND ATTACK CRUISE MISSILES	X	X	X	X	X			X	X		X			
HIGH SPEED ANTI-RADIATION MISSILE			X		X		X				X			
ADVANCED MEDIUM RANGE AIR TO AIR MISSILE			X					X						
ASSAULT BREAKER							X	X					X	
THEATER NUCLEAR FORCES			X		X		X	X			X			
AIR FORCE/NAVY TRAINER AIRCRAFT PROGRAMS	X								X			X		
NUMBER OF ISSUES (81)	8	6	13	7	9	4	8	7	5	4	4	3	2	1
PERCENT OF TOTAL ISSUES	47/81=58%						34/81=42%							

SYSTEM EFFECTIVENESS ISSUES

Issues associated with the weapon systems' effectiveness fall into the six broad categories of operational requirements, force level or mix requirements, operational or performance limitations, survivability or vulnerability, reliability or maintainability, and logistics support.

Operational requirements

Operational requirements designated for a weapon system are those approved characteristics considered necessary for that system to meet a needed defense capability. These requirements are often defined before beginning development work but may be frequently modified as dictated from development results. Issues arose where the precise role of the system or proposed requirements were questioned or not firmly established, in most instances casting doubt on the weapon's performance capabilities. Specifically:

--The need for developing the Low-Altitude Ballistic Missile Defense (LoAD) System to defend Minuteman missiles is questionable.

--The mission need for the Tomahawk Antiship Cruise Missile has never been officially approved and is in question due to the relatively low threat it will address.

--The MX system does not currently include a survivable two-way direct communication capability between higher authority and the missile launchers when the airborne launch control centers are not available. Also, some verification features of the MX, especially the view ports, appear unnecessary.

--The current design range and load capacity requirements of the C-X aircraft may not be adequate.

--The need for the KC-135 tanker aircraft reengining program may decrease because a more fuel-efficient bomber could significantly reduce tanker requirements.

--The mission analysis supporting the requirement for the JP-233 airfield attack system is incomplete.

--No mission need statement has been prepared to support the acquisition of the Tomahawk Land Attack Missile or the Medium Range Air-to-Surface Missile.

- --Requirements for twin engines and side-by-side seating are questionable for the Air Force's next generation trainer aircraft.

Force level or mix requirements

Issues involving force level or mix requirements are those in which an inappropriate weapon inventory or combination of supporting or complementing weapons hinder the effectiveness of accomplishing the desired end purpose. Specifically:

- --Uncertainty regarding the mix or quantity of weapons are a concern in the Standoff Target Acquisition System (SOTAS), Light Airborne Multi-Purpose System (LAMPS), Tomahawk and Harpoon Antiship Cruise Missiles, MX, and F-16 programs.
- --Establishing realistic inventory objectives in the land attack cruise missile program for tactical application will be complicated by uncertainties about the duplication of capability, the accuracy, and the survivability.

Operational or performance limitations

Operational or performance limitations refer to those factors which restrict a weapon system from functioning as designed or expected within its threat environment. Our reviews found that some weapon systems or subsystems are not meeting their originally established performance goals or fulfilling user needs. In other systems, the threat data indicates that enemy capabilities have been or will be enhanced to a point that questions the ability of some U.S. weapons to conduct successful operations. For example:

- --The LoAD system may not be effective against the projected threat because of certain design features. Also, additional questions exist concerning its capability.
- --The AH-64 helicopter's performance could be degraded by excessive weight and undesirable roll in its missile. Also, improvements to existing Scout helicopters to support the AH-64 may not be effective because of a lack of certain capabilities.
- --Launch opportunities for the Copperhead projectile are restricted by adverse weather, certain terrain features, and other obstructions. Also, the Copperhead's demonstrated response time so far has

been too slow to achieve a high kill probability against moving targets.

--A changing threat may require improvements in the Advanced Lightweight Torpedo's capabilities.

--The LAMPS MK III helicopter's range and endurance capabilities may be hindered by weight increases in its torpedoes. Also, reductions in system capabilities raise questions concerning the system's performance in its antiship surveillance and targeting mission.

--The utility of all antiship cruise missile systems could be decreased by a seriously limited over-the-horizon targeting capability.

--The F/A-18 aircraft's acceleration and range do not meet program goals.

--Performance uncertainties exist regarding planned improvements to the F-16 aircraft.

--The JP-233 airfield attack system's utility is limited because it can not be delivered from standoff ranges.

--The land attack cruise missiles may experience terrain contour mapping guidance and accuracy problems. These problems are also discussed in our report on theater nuclear forces.

--Possible launch at a falsely displayed target, as well as other targeting problems, may limit the High Speed Anti-Radiation Missile's effectiveness. In addition, occasional wing fluttering problems have been noted which could affect missile accuracy.

--Full use of the Advanced Medium Range Air-to-Air Missile is limited by inadequacies in the principal "identification, friend or foe" system.

Survivability or vulnerability

Survivability or vulnerability of a system is the extent to which it and its components are able to avoid or withstand a hostile environment without suffering an abortive impairment or degradation in accomplishing its mission objectives.

It presumes an enemy could inflict damage or reduce system effectiveness, and therefore, diminish the system's fighting capability. For example:

--The vulnerability of LoAD to certain types of countermeasures needs to be further explored.

--Difficulty in acquiring targets and guiding the missile to targets in high-threat environments raises concerns about the survivability of the AH-64 helicopter. Also, the smoke emitted by the Hellfire Missile could make the AH-64 even more vulnerable.

--The survivability of SOTAS has not been demonstrated.

--The LAMPS MK III helicopter could be vulnerable in its antiship surveillance and targeting mission.

--Without a strategic arms limitation agreement, it is possible that the Soviets could build enough weapons to neutralize the MX weapon system.

--Secure communication links for the Space Transportation System may not be available in time to support the first classified launch. Thus, "work around" alternatives will have to be found.

--The survivability of land attack cruise missiles when delivering certain nonnuclear warheads is doubtful under some circumstances because of exposure to enemy defense systems.

Reliability and maintainability

Reliability and maintainability levels affect the readiness, mission capability, and sustainability of a weapon system. Reliability is commonly expressed as the probability that a system will execute its intended purpose for a period of time under certain stated conditions. Maintainability is the quality of the system to be retained or restored to a specified level of performance within a given time. For example:

--Tests of the SOTAS helicopter, the Copperhead projectile, and the land attack Air Launch Cruise Missile have shown low reliability levels.

- Due to cost overruns, contractor reliability and maintainability documentation requirements for the Advanced Lightweight Torpedo were eliminated.

--Existing problems in the area of reliability and maintainability are a developmental concern in LAMPS.

--The F/A-18 aircraft has experienced reliability problems with certain subsystems. Built-in test equipment is not yet fully capable of providing required maintenance and failure information.

--Technical concerns and uncertainties raise questions regarding the F-16 aircraft's reliability.

--The High Speed Anti-Radiation Missile will be committed to limited production before a high degree of reliability has been demonstrated.

Logistic support

We identified four logistic support issues where the planned logistics (that is, parts, test equipment, personnel, facilities, tools, technical data, and so forth) did not meet system availability and wartime usage requirements. These items need to be vital considerations in the design, development, and acquisition of systems as the weapon systems are dependent on logistic support to create and sustain their effectiveness. Specifically:

--The supply support policy planned for the Aegis weapon system will not insure that the system reaches its maximum operational availability.

--There are uncertainties in acquiring the land for the MX weapon system which will affect the system's deployment. There is a need for the Department of Defense to assess the feasibility of placing one of the operating bases on excess Federal land.

--Some launch and landing facilities being built for the Space Transportation System have been delayed for 1-1/2 years.

--The F-16 is experiencing some logistic support problems. Planned improvements to the aircraft may complicate these problems.

PROGRAM ACQUISITION ISSUES

Categories we identified as affecting program acquisition are technical risks, adequacy of testing, inconsistencies with the Office of Management and Budget Circular A-109, affordability, program concurrency, cost effectiveness, program management, deployment strategy, and timeliness.

Technical risks

With the highly sophisticated/complex weapon systems being fielded today, it is not unusual to encounter technical risks during the acquisition cycle. On eight systems we examined, the risks are of a magnitude to require special attention. Specifically:

- --On the LoAD program the reduced distance between the MX shelters has possible design consequences for LoAD.
- --Technical problems with the AH-64 helicopter's target acquisition and designation sight have required changes which still have not been tested.
- --Technical risks on the Advanced Lightweight Torpedo have increased with changes in some development efforts to offset cost increases.
- --F/A-18 problems related to roll-rate, bulkhead failure, high oil temperatures, and fuel cell leakages require close evaluation.
- --On the inertial upper stage portion of the Space Transportation System, motor development efforts have experienced difficulties, software has not been completely checked out, and there is a possibility the airborne support equipment may have to be redesigned.
- --Concerns exist regarding the adequacy of the High Speed Anti-Radiation Missile's built-in test equipment and the time and labor required for adjusting each seeker and for seeker acceptance testing.
- --The Assault Breaker will be using new technologies involving medium to high risks.
- --One theater nuclear weapon, Pershing II, has yet to have its new guidance concept observed in critical operational testing of the full system.

Adequacy of testing

The adequacy of testing during weapon system development is a matter of serious concern. The purpose of conducting tests is to minimize uncertainties that could adversely affect system effectiveness, cost, or availability for deployment. We found the following examples of inadequate testing.

- --Advanced development testing on SOTAS has been curtailed to expedite development.
- --A critical subsystem was selected for the CG-47 before adequate technical testing was conducted.
- --Technology supporting the cratering submunition for the JP-233 system has yet to be validated through actual flight tests.
- --Testing of the land attack cruise missile guidance set has not been operationally realistic. Some critical components were not available for testing in the Air Launched Cruise Missile program. Also, accuracy of missiles with conventional warheads will not be satisfactorily demonstrated before full-scale production.
- --Full testing of the Advanced Medium Range Air-to-Air Missile during engineering development may not be possible because of deficiencies in targets.
- --Testing planned on the Assault Breaker in advanced development may not be sufficient to demonstrate that the system is ready to enter full-scale engineering development.
- --A production decision on the Pershing II theater nuclear missile is due after only two test firings.

Inconsistencies with Circular A-109

We found five instances of inconsistencies with the Office of Management and Budget Circular A-109. The circular, issued in April 1976, establishes policy for executive agencies to follow in managing the acquisition of major systems. The primary objective was to have agencies acquire major systems consistent with the agency's principal needs. Specific findings include

- --the mission need for the Tomahawk Antiship Missile has never been approved by the Department of Defense;
- --perceived mission needs related to planned F-16 improvements have not been identified, and alternatives have not been solicited and evaluated in accordance with Circular A-109;

--the Air Force issued requests for proposals on the C-X aircraft before the mission element need statement was approved;

--development of the Medium Range Air-to-Surface Missile is proceeding despite no approved mission element need statement; and

--requests for proposals and quotations on the trainer aircraft programs contained restrictions which precluded consideration of some potential solutions.

Affordability

The issue of affordability arises when persistent or unforeseen cost increases in a weapon program question the continued availability of funds or disrupt the procurement expectations for other programs. Such strains on the defense budget often result in compromises in the military requirements of the system, delays in fielding other new equipment, longer acquisition cycles, equipment inventory shortages, and inefficient rates of production. Specifically:

--Due to tight budget constraints, deferred funding levels for the AH-64 helicopter have stretched out its procurement schedule.

--The program cost estimate for the F/A-18 aircraft has increased considerably and may still be underestimated because of the inflation rates being used for future years.

--Funding required for other current long-range, high-cost Air Force programs raises questions regarding the affordability of the KC-135 reengining program and planned F-16 enhancements.

Program concurrency

Program concurrency occurs when production begins before development is complete and the system is approved for service use. In the absence of an overriding immediate military need, concurrency is generally undesirable because it frequently increases the degree of program risk and often results in higher costs and lower performance. Our reviews found

--a very ambitious SOTAS program schedule, curtailing some testing, might prove troublesome for such an advanced system and

--Development/production concurrency in the Air Launched Cruise Missile, High Speed Anti-Radiation Missile, and Pershing II missile programs may raise the risk that many major refinements will have to be made after production has started.

Cost effectiveness

On three of the systems we reviewed, we identified cost-effectiveness issues. On the LoAD system, we concluded that it is an economical option for maintaining MX survivability. On the other two systems, a question exists over whether the options being pursued are the most effective at the least cost. Specifically:

--On the KC-135 modification program, rehabilitation of existing engines may be a cost-effective alternative to the reengining program.

--The relative cost effectiveness of various trainer aircraft alternatives is uncertain.

Program management

In two of our reviews, we found a need for better program management. Specifically:

--There are three different project offices developing the three major SOTAS components. These offices operate independently and are separately responsible for the components they manage. This diffused management approach appears to compound the program difficulties being encountered.

--Assault Breaker is presently managed by a small group in the Office of the Secretary of Defense supplemented by ad hoc committees. This structure appears to be insufficient to handle a program as large and complex as Assault Breaker.

Timeliness

On the KC-135 aircraft modification program, timeliness of the program is an issue. The slow pace of the program raises serious questions whether the program will correct existing problems with aging engines and increase tanker capacity in a timely manner.

POTENTIAL IMPACT OF OUR RECOMMENDATIONS

In our reports we have made a number of recommendations to both the Congress and the Secretary of Defense. These recommendations, cited in the summaries in chapters 2, 3, 4, and 5, are intended to address the issues just discussed and to contribute to overall improvement in the management of the programs and development of the systems. The potential impacts of these recommendations fall into five broad categories--minimize risk and ensure effectiveness, improve disclosure to the Congress, affirm requirements, evaluate alternatives, and reduce costs. (See matrix on p. 13.)

Many of our recommendations are intended to minimize risks and ensure the effectiveness of the systems. Recommended actions include improved testing, closer program reviews, and restrictions on the appropriation and obligation of procurement funds until most risks and uncertainties are resolved. While we recognize that it is unrealistic to resolve all problems and uncertainties during development, experience has shown that problems identified during development which go unresolved often lead to serious problems once the systems are deployed. By resolving most of these problems now, we believe that many future operational and support problems can be avoided, leading to improved weapon system capability and readiness.

On many programs we see a real need for the Department of Defense to improve its disclosure to the Congress on program status and issues. The Congress, in its oversight role, needs to be provided more accurate and complete information on the cost, schedule, and performance of these multibillion dollar programs which are such a significant part of the Federal budget and on which our future military posture is so dependent. Such disclosure will lead to better overall management of Defense programs.

Recommendations directed at affirming requirements are intended to provide assurances that the systems and subsystems being deployed and the quantities which are programed for purchase are commensurate with the mission needs being addressed. On a number of the systems--LoAD, Tomahawk Antiship Cruise Missile, F-16 enhancements, C-X, KC-135, JP-233, and two land attack cruise missiles--we found that questions concerning the requirements for these systems need to be resolved. On seven systems--SOTAS, Copperhead, LAMPS, and two antiship cruise missile systems--we are recommending a reexamination of the planned procurement quantities because the current programed buys do not appear to accurately reflect what will be needed.

POTENTIAL IMPACT OF GAO RECOMMENDATIONS ON SELECTED MAJOR WEAPON SYSTEM PROGRAMS

AIM OF OUR RECOMMENDATION IS TO: REPORTS ISSUED ON:	MINIMIZE RISK/ ENSURE EFFECTIVENESS	IMPROVE DISCLOSURE TO THE CONGRESS	AFFIRM REQUIREMENTS	EVALUATE ALTERNATIVES	REDUCE COSTS
ARMY PROGRAMS					
LoAD BALLISTIC MISSILE DEFENSE	X		X		X
AH-64 ATTACK HELICOPTER	X	X		X	
STANDOFF TARGET ACQUISITION SYSTEM	X		X		
COPPERHEAD PROJECTILE	X		X		
NAVY PROGRAMS					
ADVANCED LIGHTWEIGHT TORPEDO	X	X			
LIGHT AIRBORNE MULTI-PURPOSE SYSTEM	X	X	X		
AEGIS/CG-47	X	X			X
ANTISHIP CRUISE MISSILE PROGRAMS	X		X		
F/A-18 AIRCRAFT		X			
AIR FORCE PROGRAMS					
MX WEAPON SYSTEM		X		X	X
SPACE TRANSPORTATION SYSTEM		X			
F-16 AIRCRAFT		X	X		
C-X AIRCRAFT			X	X	
KC-135 AIRCRAFT MODIFICATIONS			X	X	X
JP-233 AIRFIELD ATTACK SYSTEM			X	X	
JOINT PROGRAMS					
LAND ATTACK CRUISE MISSILES	X		X		
HIGH SPEED ANTI-RADIATION MISSILE	X	X			
ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE	X	X			
ASSAULT BREAKER	X			X	
THEATER NUCLEAR FORCES	X	X			
AIR FORCE/NAVY TRAINER AIRCRAFT PROGRAMS	X	X		X	

On seven programs we found a need to evaluate alternatives to systems or actions currently planned. In each of these programs we believe that such an evaluation is needed because other attractive alternatives are available. These evaluations, thus, will offer the opportunity to identify less costly and/or more effective alternatives to existing plans.

On four programs we found specific opportunities to reduce costs. On the LoAD System program, we recommend that serious consideration be given to discontinuing that part of the program directed toward defense of Minuteman missiles as the need for such a defense is questionable. On the CG-47 cruiser program we question the need for one of the air search radars, as the added capability it provides does not appear commensurate with the added cost and weight that results. The MX program costs can be reduced through the elimination of view ports, which appear to be an unnecessary verification feature in the MX design. There also appears to be an excellent opportunity for substantial cost savings through termination of the KC-135 aircraft modification program.

The remainder of this report contains the summaries of our 24 reports. Instructions for obtaining copies of the full reports are on the inside front cover of this report. To obtain copies of reports which are classified (those report numbers beginning with a "C"), security clearance information must be provided along with a demonstrated need to know. Appendix I lists other relevant reports issued on military acquisitions and related work from March 1980 through April 1981.

CHAPTER 2

ARMY PROGRAMS

POTENTIAL OF LoAD BALLISTIC MISSILE DEFENSE SYSTEM FOR PROTECTING THE MX SYSTEM

An objective of U.S. national defense policy is to maintain a force of land-based intercontinental ballistic missiles (ICBMs) capable of surviving a Soviet attack in numbers adequate for a retaliatory strike. Because of concern over the survivability of the Minuteman missiles, the Department of Defense (DOD) plans to deploy a new ICBM system, called MX, in multiple, protective shelters.

To offset additional increases in the Soviet threat to U.S. land-based ICBMs which are possible under the Strategic Arms Limitation Talks II Treaty, the initial MX system could be expanded by deploying more MX missiles and shelters. If the treaty is not ratified or is canceled and the Soviet threat continues to increase, DOD could either expand the MX system and/or defend the existing MX missiles with a ballistic missile defense system, assuming that the Anti-Ballistic Missile Treaty had been modified or terminated.

To provide the option for defending U.S. ICBMs, the Army is conducting a preprototype demonstration of a ballistic missile defense system called the low-altitude defense (LoAD) system. The demonstration program's goal is to provide the capability for deploying LoAD soon after the preprototype demonstration is completed. Deploying LoAD would require terminating or modifying the Anti-Ballistic Missile Treaty, which sharply limits the United States' and Soviet Union's development and deployment of ballistic missile defense systems.

The LoAD preprototype demonstration represents a major effort within the Army's ballistic missile defense program. The Army plans to fund LoAD by reducing other ballistic missile defense efforts and increasing its overall ballistic missile defense budget.

The LoAD defense unit, as defined for the MX defense mission at the time of GAO's review, is to include a radar, data processor, and missiles armed with nuclear warheads. One LoAD defense unit would be needed for each MX missile to be defended.

The MX basing mode is still uncertain. In April 1980 plans were for MX to be based in multiple, protective shelters with each missile being deployed in 1 of 23 shelters arranged in a cluster. Other basing modes are also under consideration which may affect LoAD's configuration. MX deployment is to start in 1986 and is initially expected to include 200 missiles and 4,600 shelters. Proliferation of more missiles and shelters could be necessary for survival of an adequate retaliatory force against the maximum threat level.

LoAD APPEARS TO BE AN ECONOMICAL OPTION FOR MAINTAINING MX SURVIVABILITY

LoAD, if it can be developed to operate effectively, appears to be an economical way of assuring MX's survivability against threat levels exceeding the constraints of the Strategic Arms Limitation Talks II Treaty.

The validity of LoAD's cost advantage hinges on two major assumptions: (1) the Army and Air Force's cost estimates for each alternative are credible and (2) LoAD will be developed to operate effectively. However, LoAD's potential cost advantage over MX proliferation is substantial.

Assuming a large increase in Soviet reentry vehicles, LoAD could lose its advantage only if its cost increased 167 percent while the MX cost remained constant. Also, LoAD's predicted effectiveness could decrease substantially (assuming costs had not changed) before LoAD would lose its advantage over the MX proliferation alternative.

LoAD IS NOT BEING DESIGNED TO MEET THE RESPONSIVE THREAT

To assure that LoAD will be effective, it must be designed to meet the Soviet threat that will exist during its deployed lifetime. Projections by the intelligence community must be used to develop a threat for use in designing the system. The projected threat, which the Army is using to design LoAD, is less severe than the threat projected in some intelligence assessments.

Unless the Army adequately considers the more severe threat in designing LoAD, it may not be a genuine option for assuring MX's survivability.

AGENCY COMMENTS

DOD maintains that the Army's design approach for LoAD is proper in that the system is being designed to meet the projected threat and to provide options for responding to growth in the threat. It believes that Soviet responses to LoAD are long leadtime efforts which will allow sufficient time to change LoAD's design.

This position may be valid if it is assumed that the Soviets will not respond to LoAD by developing a means believed to overcome it. But, the contrary assumption could result in fielding a costly, ineffective system, much like the Army's Safeguard system. After developing and deploying that antiballistic missile system at a cost of over $7 billion, the Safeguard system was deactivated because of its high cost and potential ineffectiveness against the increasing threat.

Changing LoAD to respond to the Soviet threat could involve more than simple modifications. DOD's belief that there will be sufficient time to respond to the severe Soviet threat after it is detected in testing may prove valid but at this point appears unfounded, since the Army has not identified how LoAD could be changed to make it effective.

CONCLUSIONS

An effective LoAD appears to be an attractive option to develop as a hedge for protecting MX against an unconstrained threat.

However, LoAD is being designed against a projected threat which, according to some intelligence assessments, is much less severe than what LoAD may actually face. The more severe threat could prevent LoAD from being a genuine option for assuring MX's survivability.

GAO recognizes that the decision on the threat against which LoAD should be designed is largely subjective; that is, how the Soviets will respond to LoAD cannot be predicted with certainty. But, to design LoAD as though the Soviets will not respond in a way believed to defeat the system could result in adverse consequences, including the need to hastily double the MX deployment. Because of the importance of ICBM survivability to the U.S. defense posture and LoAD's promise for assuring this survivability, GAO believes that the matter should be thoroughly examined now while LoAD's development is in the early stages.

RECOMMENDATION TO THE SECRETARY OF DEFENSE

GAO recommends that the Secretary of Defense determine whether the assessment of the responsive threat to LOAD's performance has used appropriate assumptions. GAO believes that the Army used an inappropriate assumption leading to the erroneous conclusion that LoAD would not be adversely affected by the threat.

RECOMMENDATION TO THE CONGRESS

GAO recommends that the Congress evaluate the Army's plans for developing LoAD and determine whether it concurs with the Army's plans for developing LoAD to meet a less severe threat than it may actually face.

ISSUES CONCERNING DEVELOPMENT OF BALLISTIC MISSILE DEFENSE SYSTEMS

The Army is conducting a preprototype demonstration of a ballistic missile defense system for possible defense of U.S. land-based intercontinental ballistic missiles. The system, referred to as LoAD (low-altitude defense), would use missiles armed with nuclear warheads to destroy reentry vehicles targeted at U.S. missiles. The objective of this program is to achieve the capablility for rapidly completing development and deployment of LoAD.

GAO reported in November 1980 (C-PSAD-81-2) on the LoAD system's potential cost effectiveness for defending the MX missile. GAO concluded that LoAD appeared to be an economical option for assuring MX survivability but raised issues concerning LoAD's potential effectiveness.

The Army is also conducting a technology demonstration program for an interceptor that would have a nonnuclear warhead.

REDUCTION IN MX'S SHELTER SPACING

The distance between MX shelters was reduced to decrease the amount of land required for MX. The Congress may wish to weigh the benefits of the reduced land requirements against the possible consequences for LoAD's performance and determine whether it agrees with the Department of Defense's decision.

NEED TO DESIGN LoAD FOR MINUTEMAN DEFENSE IS QUESTIONABLE

During the next 2 years of the preprototype demonstration program, the Army is planning to design two versions of LoAD--one for defending MX and another for defending Minuteman. DOD agrees that defending MX is clearly the better alternative for maintaining a survivable land-based intercontinental ballistic missile force.

The Army's initial efforts to develop LoAD for Minuteman defense may have appeared justified when the LoAD program began because of the uncertainty surrounding the MX program at that time. However, the MX program has since been approved by the Congress and the uncertainty has thus diminished.

In GAO's opinion, the resources that will be devoted to LoAD's development for Minuteman defense could be more effectively used to expedite the design of LoAD to defend MX.

Although program officials agree that defending Minuteman would be more costly and less effective than defending MX, they believe that Minuteman is a valuable asset which the United States should maintain the option of protecting.

Matter for consideration by the Congress

GAO believes that the Congress may wish to consider whether DOD should continue that part of the LoAD program directed toward Minuteman defense.

THE ENDOATMOSPHERIC NONNUCLEAR LOW-ALTITUDE TECHNOLOGY DEMONSTRATION PROGRAM SHOULD BE REORIENTED

In GAO's opinion, the Army's current nonnuclear program should be reoriented toward developing and demonstrating the technology for a higher altitude system which could have a valid potential use. The Army plans to spend substantial funds on its program but will not resolve the critical issue pertinent to a higher altitude system which could have a valid use. Much of the technology being pursued could be useful in a program oriented toward a higher altitude system. However, the current program, even if successful, would only demonstrate a low-altitude capability. To have the same confidence that a nonnuclear system could be effective at higher altitudes would require another technology development and demonstration.

Program officials are not convinced that reorientation of the current program is necessary. GAO believes that failure to reorient the program will result in a waste of time and money. They also maintain that GAO erroneously characterizes the technology program as a development program for a system to accomplish specific missions and that analysis of potential missions is premature. GAO disagrees and believes that now is the best time to analyze the potential usefulness of the technology while the program is in the early stages and sunk costs are at a minimum.

Recommendation to the Secretary of Defense

GAO believes the Army's current nonnuclear low-altitude program is unjustified. GAO recommends that the Secretary of Defense require the Army to reorient the nonnuclear program to assure that the technology developed is applicable to a system concept having a valid potential use and achieving the advantages possible in a nonnuclear system.

Recommendation to the Congress

GAO discussed extensively with responsible DOD and Army representatives the facts, conclusion, and recommendation on the nonnuclear program. Army officials directly responsible for the technical direction of the program agreed that GAO's recommendation has merit. Higher level management officials at DOD are undecided. After careful consideration of DOD's comments, GAO continues to believe that the recommendation to the Secretary of Defense to reorient the program is valid.

Therefore, unless DOD reorients the program or provides convincing evidence that reorientation is not needed, GAO recommends that the Congress terminate the program.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

PROBLEMS AFFECTING THE PROCUREMENT AND OPERATION OF THE ARMY'S AH-64 ATTACK HELICOPTER AND ASSOCIATED SYSTEMS

The attack helicopter, with its guided missiles and other armament, plays a key role in supporting ground troops battling enemy armored units concentrated around the forward edge of the battle area. The Army's newest attack helicopter, the AH-64, will carry the new laser-guided Hellfire missile. A production decision for each is due late in calendar year 1981.

In addition to these new acquisitions, the Army has plans to continue upgrading its current fleet of attack helicopters, the Cobra, which carries the tube-launched, optically tracked, wire-guided missile, to extend their operational life into the next decade. The Army also plans to improve a different helicopter to support the attack helicopters in a scouting role. The total estimated program costs of the Army's new acquisitions and planned improvements within this aerial antiarmor area represent an investment of about $12.5 billion.

BUDGET CONSTRAINTS ARE ADVERSELY AFFECTING HELICOPTER PROCUREMENT PROGRAMS

Due to the steadily increasing cost of weapon systems and to budget constraints, the Army has determined that it cannot afford to buy or improve the full quantity of weapons it feels it needs to modernize its forces within desired time frames. Consequently, the Army is stretching out the procurement schedule of some weapons, an action which results in increased costs, and is deferring others. The AH-64 and Hellfire are two systems whose procurement is being stretched out. Due to higher priorities, the full upgrading of about half the Cobra/tube-launched, optically tracked, wire-guided missile fleet has been deferred as have plans to develop a multipurpose lightweight missile. The scout helicopter improvement program may also fall victim to the affordability problem because it would require a large expenditure of procurement funds which have yet to be approved.

TECHNICAL PROBLEMS STILL TO BE RESOLVED

In addition to their cost, some technical problems disclosed in development testing of the AH-64 and Hellfire pose additional problems for the Army. Some are more serious than others and, collectively, the problems can degrade the helicopter's performance to a considerable degree unless corrected.

Excessive aircraft weight is preventing the AH-64 from achieving its required vertical rate-of-climb requirement. Unless weight reduction efforts are successful, more powerful engines may be needed to overcome this deficiency. The helicopter's target acquisition and designation sight is not meeting all of its requirements and has undergone several needed design changes. These changes must still undergo extensive testing. Although major design changes have reduced a longstanding vibration problem, the helicopter is still experiencing greater than desired vibration levels. Excessive vibration causes pilot fatigue and affects operating proficiency.

Hellfire is experiencing an undesirable roll rate problem after it is launched from the AH-64 that makes it difficult to control the missile to the extent desired. Hellfire also emits unwanted smoke which could affect the helicopter's survivability and degrade its performance.

OPERATIONAL CONSTRAINTS IN CENTRAL EUROPE LIKELY TO LIMIT TARGET OPPORTUNITIES

The difficulties of the attack helicopter's mission are well known. The aircraft will have to operate selectively because of the high-threat environment anticipated in central Europe and because of natural constraints like terrain and weather which make target engagements difficult. Successful system employment depends heavily on line-of-sight to the target. Obscurants like smoke and dust and adverse weather would also present a challenge to the AH-64's infrared and laser technology. Army operational tests, scheduled for the summer of 1981, will provide the opportunity to evaluate the AH-64's effectiveness in this type of combat environment.

DOUBTFUL EFFECTIVENESS OF PROPOSED SCOUT HELICOPTER

The Army is improving an existing helicopter to perform the scout role to support the attack helicopter. The choice is between the OH-58 and OH-6. It is questionable that, even with the improvements, either aircraft could be used very effectively with the AH-64. Both scout candidates are underpowered and do not have the agility or night vision capability to be compatible with the new attack helicopter. The Army believes that other potential uses for the scout helicopter exist, but these have to be further assessed.

CONCLUSIONS

An affirmative decision to proceed with the production of the AH-64 and Hellfire should await the successful resolution of the system's major technical problems and an assessment of its operational effectiveness. In addition, there are alternatives to stretching out the helicopter and missile procurement programs that should be considered, which might achieve the aerial antiarmor mission objectives more economically.

RECOMMENDATIONS

GAO recommends that the Congress place restrictions on the obligation of fiscal year 1982 procurement funds for the AH-64 and laser Hellfire until the Secretary of Defense has assured the House and Senate Armed Services and Appropriations Committees that the system's critical technical problems have been corrected.

GAO also recommends that the Secretary of Defense:

--Ensure that the AH-64, with the laser Hellfire system on board, is adequately tested and evaluated under operational conditions representative of a high-threat European environment before approving full production.

--In view of its apparent incompatibility with the AH-64, determine whether there are other potential uses for the scout helicopter important enough to warrant requesting procurement funds from the Congress for an improvement program.

In view of the high investment cost planned or programed for aerial antiarmor weapons and the Army's affordability problems, GAO further recommends that the Secretary of Defense provide the House and Senate Armed Services and Appropriations Committees, during the fiscal year 1982 budget hearings, with an assessment of other program alternatives to include:

--An identification of lower priority programs that could be terminated or deferred to fully fund and restore the AH-64 and laser Hellfire to their original procurement schedules if development and operational problems are satisfactorily resolved.

--The merits of purchasing fewer AH-64s and fully upgrading the full fleet of Cobras.

--Trade-offs within the procurement budget that would permit improving the scout helicopter, if it is needed.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the programs to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

THE ARMY'S STANDOFF TARGET ACQUISITION SYSTEM--A PROGRAM HAVING DEVELOPMENT DIFFICULTIES

The Standoff Target Acquisition System (SOTAS) is a $1.1 billion Army program to develop an airborne radar system to detect and locate moving targets at distances far beyond the forward edge of the battle area. Although experimental SOTAS models have been fielded in Europe for about 2 years, a better model, operating from a new helicopter with an advanced radar and a jam-resistant data link, is now in development.

SOTAS can add a significant military capability to the Army. However, the system has experienced technical difficulties which are causing significant delays in the program's schedule and which could signal substantial cost overruns. Principally, the problems arose because SOTAS did not lend itself to the fast-paced development effort the Army has attempted in order to field the system quickly. The system's initial operating capability date has slipped several years.

The Department of Defense chose to expedite development of SOTAS by curtailing some of the testing normally done in the advanced development phase and by placing the next phase--engineering development--on a very ambitious schedule. However, the system being developed in the engineering development phase is significantly different and more advanced than the model used in Europe.

Difficulties have been compounded because

--the most critical components involved advanced technology and were creating technical problems that were not anticipated by the Army and its contractors;

--a critical component that is being developed, the data link, has to meet the requirements of two other programs that are unrelated to SOTAS;

--the management of the major SOTAS components--the helicopter, the radar, and the data link--has been diffused among three project offices which operate independently and are separately responsible for the performance of the components they manage;

--the SOTAS project office has not been able to provide the necessary intensive program management because of limited resources.

The Army expects SOTAS to be a high-priority target. This dictates that SOTAS be made as survivable as possible. The Army's analysis of SOTAS survivability, made in 1978, was based on threat assessments that were not current at that time. New developing threats have prompted an updated survivability analysis, which is due to be completed this spring. There are indications that it is technically feasible to improve the system to counter the increased threat.

SOTAS is using the Black Hawk helicopter modified for the SOTAS target acquisition mission. Black Hawk reliability demonstrations shows that a mission abort due to a malfunction can be expected with a frequency more than twice the rate the Army considers acceptable. Unless there is substantial improvement, more SOTAS helicopters may be required to accomplish the SOTAS mission.

RECOMMENDATIONS

GAO recommends that the Secretary of Defense require the Army to

--perform a sufficient number of integrated tests involving the helicopter, radar, and data link to assure that the SOTAS will meet its performance and reliability requirements and

--reevaluate quantity requirements for the SOTAS helicopters based on the Black Hawk's demonstrated mission reliability.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with the management of the program to assure that the report is accurate and complete. Their points of view are included as appropriate.

FUTURE PROCUREMENTS OF THE ARMY'S COPPERHEAD PROJECTILE SHOULD BE CONTINGENT ON IMPROVEMENTS IN PERFORMANCE AND RELIABILITY

Copperhead, a laser-guided, antiarmor projectile launched from 155-mm. howitzers, entered limited production this year. It is a $1 billion program. The Army plans to procure over 44,000 rounds by 1986 at an estimated average cost of over $22,000 per round.

Army officials continue to maintain that Copperhead will provide the artillery with an unprecedented antiarmor capability. However, like all weapons which depend on laser guidance, Copperhead's effectiveness hinges on a laser designator operator's ability to keep the target in sight and focus the laser beam on the target. The projectile's seeker can then home on the reflected energy.

VISIBILITY IS A FACTOR

In a European combat environment, good visibility conditions would more often than not be unattainable. Adverse weather, obstructed terrain features, and certain other obstructions can be expected to restrict opportunities for launching Copperhead. In live firings conducted during operational testing under a variety of conditions, Copperhead hit the target in 29 of 71 attempts. For those firings conducted in obstructive conditions, the results showed that the probability of destroying a target with a single Copperhead round was considerably lower.

RESPONSE TIME MAY BE CRUCIAL

Tests up to this point provide little insight into the effectiveness to be anticipated from Copperhead against moving targets. The Army estimates that two-thirds of the targets on the battlefield will be moving. To successfully attack them would require a fast response time, starting with the forward observer's detecting the target and ending with the projectile's hitting it.

The Army would like this response time to be no more than 106 seconds. An Army analysis of moving targets in a European environment found that the probability of maintaining the necessary line-of-sight decreases as the response time is lengthened because the target may become obscured or move out of Copperhead's maneuverability area. In live firings during operational tests, the response time for preplanned missions far exceeded the response time desired by the Army. For missions that were not preplanned, it was still greater.

DEVELOPMENT IMPROVEMENTS

Two developments may help raise Copperhead's performance to more acceptable levels. A modified seeker, expected to significantly improve Copperhead's performance in smoke, was tested in February 1980 with good results. Also, digital equipment under development, designed to provide more rapid data transmission and target data computations, is expected to reduce Copperhead's response time.

RELIABILITY STILL UNCERTAIN

Copperhead's reliability in both operational and development tests were so low that the Secretary of Defense directed initial procurement to be limited to a rate of 200 per month. The Army's reliability requirement is 91 percent. The Secretary has required the Army to bring the reliability level up to at least 80 percent before the procurement rate could be increased. Army estimates of Copperhead's reliability as demonstrated in testing ranged from 45 to 72 percent, based on varying criteria applied by different Army evaluators. The principal reliability problems were discovered during tests in which Copperhead was subjected to shock and vibration. The deficiencies were related to an electrical cable, wing failures, and the stabilizing sensor.

CONCLUSIONS

Copperhead's greatest contribution promises to be its precision accuracy, which should permit the Army to score many more first round hits against stationary targets than it can with existing artillery munitions. But, its ability to respond in the expected European environment must improve sufficiently to also permit better success against moving targets. If Copperhead remains useful only against stationary targets and then only in conditions of good visibility, the question arises as to whether the Army would still need the full programed quantity of over 44,000 projectiles.

The Secretary of Defense has appropriately limited the current rate of procuring Copperhead pending the resolution of its reliability problems. GAO believes that the Department of Defense should also make future procurements of Copperhead conditional upon its showing improved effectiveness against moving targets.

RECOMMENDATIONS

GAO recommends that the Secretary of Defense

--continue limited production of Copperhead until it has demonstrated an ability to achieve a response time that would improve its performance against moving targets and has attained the required level of reliability and

--reassess the need for procuring the total Copperhead quantity currently programed if such responsiveness and reliability are not demonstrated.

AGENCY COMMENTS

GAO discussed the issues in this report with Department of Defense officials associated with the management of the Copperhead program and provided them with a draft of this report for comment. They agreed with GAO's conclusions and recommendations. Their suggestions for improving the report's technical accuracy have been incorporated as appropriate.

CHAPTER 3

NAVY PROGRAMS

THE NAVY'S LIGHTWEIGHT TORPEDO: A NEW WEAPON THAT FACES MANY DEVELOPMENT CHALLENGES

The Advanced Lightweight Torpedo (ALWT) is the Navy's newest antisubmarine warfare weapon. It is intended as the replacement for the Navy's current lightweight torpedo, the MK-46.

In July 1979 the ALWT program received approval to begin advanced development, and in August 1979 two competitive advanced development contracts were signed. Both contractors are to competitively design, build, and test their proposed ALWT concepts, leading to a full-scale engineering development decision in April 1983.

GAO noted the following during its review:

--ALWT is intended to address the advancing Soviet submarine threat and overcome deficiencies in current lightweight torpedoes. However, the severity of the Soviet threat has increased signficantly since the ALWT requirement was issued, particularly in the areas of speed and depth capability. Thus, the advanced development baseline design may require enhancement. The Assistant Secretary of Defense has recommended that the Navy begin efforts to develop enhancements to key subsystems such as the warhead and propulsion.

--Navy analysis has shown there is no viable alternative to developing a new lightweight torpedo. Other free world torpedoes available or under development do not possess the performance necessary to satisfy the Navy's requirements.

- --Early in advanced development, cost overruns were encountered by both contractors which prompted (1) deleting warhead development as a contractor responsibility, (2) eliminating documentation in weapon system integration, design to cost, life-cycle cost, and reliability and maintainability, and (3) reducing planned subsystem and system-level testing. These changes, however, may result in greater program risks.

- --A Selected Acquisition Report which advises the Congress on status of cost, schedule, and performance for ALWT will probably not be prepared until 1983.

- --The ALWT warhead technology must still be developed and proven in the ALWT application. A more advanced warhead is being investigated, but its performance still needs to be determined.

- --Since ALWT is likely to be longer and significantly heavier than the MK-46 torpedo, modifications to a variety of surface ship and aircraft launch platforms will be required.

- --Availability of a new advanced torpedo target system, currently under development, is critical for ALWT testing.

- --Navy development to date generally compares favorably with the Office of Management and Budget Circular A-109's principles. Should the Navy attempt to direct technical transfusion later as now indicated, procurement principles would be violated and development risks will likely increase.

CONCLUSIONS

Continued increases in the Soviet threat have significantly degraded the effectiveness of the MK-46 torpedo. Since no known alternative torpedoes exist, the Navy believes there is a clear need for ALWT.

Should ALWT perform as planned, it will provide a valuable addition to the Navy's antisubmarine warfare capability. However, ALWT is still early in development and faces many challenges as development continues. Cost increases have affected the Navy's original development plan, and some efforts have been deferred even before significant testing has begun. As a result, advanced development risks have increased. Continued advances in Soviet submarine capabilities have raised questions as to the adequacy of the present ALWT design.

RECOMMENDATIONS

GAO recommends that the Secretary of Defense direct the Navy to

--reexamine the wisdom of the reductions in reliability, maintainability, platform integration, and testing that have resulted from changes in contract documentation requirements in light of their potential future effect on the program and

--begin preparing a Selected Acquisition Report now for the program to help insure adequate attention to cost, schedule, and performance goals.

In view of the issues raised in this report, GAO recommends that the Congress direct the Secretary of Defense to periodically provide it with an assessment of the ALWT technical and programmatic issues and plans for dealing with them.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

THE LIGHT AIRBORNE MULTI-PURPOSE SYSTEM, LAMPS MK III, PROGRESS EVIDENT BUT SOME PROBLEMS AND QUESTIONS REMAIN

The newest antisubmarine helicopter weapon system being developed by the Navy is the Light Airborne Multi-Purpose System (LAMPS MK III). It is a computer-integrated ship and helicopter system designed principally for antisubmarine warfare (ASW) with secondary mission capabilities of antiship surveillance and targeting (ASST), search and rescue, medical evacuation, and logistics support. The program is currently in full-scale development. Scheduled for deployment aboard cruisers, destroyers, and frigates, the helicopter designated the SH-60B Seahawk, is a derivative of the Army's UH-60A Black Hawk troop assault helicopter.

The LAMPS MK III is a follow-on to the MK I system first deployed in 1971. The MK I is a limited capability system consisting of an H-2 helicopter equipped with "off-the-shelf" avionics and is based primarily aboard older modified FF-1040 and FF-1052 class warships. The MK I is currently undergoing an avionics improvement program to upgrade its capabilities although not to the level of the LAMPS MK III.

During GAO's review of the LAMPS MK III program, we found potential problems which raise questions about the ability of LAMPS to carry out both its ASW and ASST missions. In addition, the cost of deploying the LAMPS MK III system has grown by 50 percent in the past year from approximately $3.6 billion to $5.4 billion. Further, a cost increase of $1.6 billion was identified in January 1981, raising total program costs to $7 billion. This represents a cost growth of nearly 100 percent in 16 months.

ANTISUBMARINE WARFARE MISSION

In its ASW role, the LAMPS MK III helicopter (known as the Seahawk) acts as an extension of shipboard systems by providing a remote platform for deploying sensors, transmitting and processing sensor data, and prosecuting attacks on targeted submarines.

In performing its ASW role, the LAMPS MK III weapon system is dependent on other systems to detect, classify contacts, and prosecute an attack. Therefore, its effectiveness is contingent on the performance of those systems. Some of these systems, such as the new Tactical Towed Array Sonar System, passive sonobuoys, and the MK 46 torpedo, were delayed in development or have known performance limitations. Further, the weight of the advanced lightweight torpedo, being developed to replace the MK 46 torpedo, may be of concern because of its effect on the range and endurance of the LAMPS helicopter.

REQUIREMENT COMPROMISED

Studies have shown that the Navy is not planning to buy enough Seahawks to meet projected requirements. An estimate presented to the Chief of Naval Operations Executive Board shows that the Navy may be planning to buy fewer Seahawk helicopters than the minimum required. The Navy feels, however, that buying 204 helicopters is a reasonable compromise based on the funds available. In GAO's opinion, this results in significantly understating the total cost of an effective program. The Navy should determine its MK III helicopter requirements and also alternate means of meeting these requirements if affordability is a serious problem. Otherwise, the Navy may end up with too few helicopters to meet its ASW requirements and no plan to bridge the gap.

RELIABILITY AND MAINTAINABILITY CONCERNS

Early flight and equipment testing of the LAMPS MK III helicopter system are proceeding well. However, some problems particularly in the area of reliability and maintainability exist which are of developmental concern. Also, data obtained from the Army's Black Hawk program indicates that there may be potential problems in meeting the high-reliability, availability, and maintainability objectives established for the LAMPS MK III system.

ANTISHIP SURVEILLANCE AND TARGETING MISSION

The ASST mission of the LAMPS MK III was reduced from a primary to a secondary mission as a cost savings measure in response to congressional direction. The resultant decrease in hardware capabilities reduces LAMPS MK III capability to carry out this mission. LAMPS MK III helicopters suffer from equipment limitations and could be vulnerable when performing the ASST mission. In addition, it is a lower priority platform for over-the-horizon targeting and would probably be too busy performing the ASW mission to perform the ASST mission in time of war. If the Navy is to make effective use of antiship missile systems, such as the Harpoon, it must address the problems and questions relating to the ability of the LAMPS MK III system to successfully carry out this mission.

POTENTIAL FOR FUTURE COST INCREASES

From September 1979 to September 1980, LAMPS program costs have increased by 50 percent. If realistic inflation rates were used the increase would be even greater. Further cost increases are likely because of changes in the Army's Black Hawk helicopter procurement plans which would raise the unit cost of the Seahawk.

New data, which became available in January 1981 during preparation of this report, indicates that total program costs will increase by $1.6 billion. The increases are due to inflation, reductions in the Black Hawk program, and additional nonrecurring startup costs for the production phase.

RECOMMENDATIONS

It is essential that the Congress, in its oversight role of Defense, have a clear understanding of the issues, problems, and potential problems that exist. Such is the case with the interrelationship and interdependence of these key weapon systems that are being acquired to carry out the Navy's ASW reponsibilities in countering the Soviet threat. Therefore, GAO recommends that the Secretary of Defense address these issues and present a plan to the Congress that will sufficiently identify strengths and weaknesses of the capabilities of the LAMPS and its related systems to satisfactorily perform the ASW mission.

Further, GAO recommends the Secretary of Defense require the Navy to:

- --Determine the number of LAMPS MK III helicopters needed to effectively meet its ASW mission requirements.
- --Clearly establish the role the LAMPS MK III system is expected to fill in the ASST mission and, if the ASST mission is a major responsibility, identify actions needed to provide the desired capability.
- --Reassess the reliability, availability, and maintainability aspects of the LAMPS MK III to determine whether it will be adequate to meet its operational requirements.
- --Determine the cost impact of actions resulting from the above recommendations and disclose this information to the Congress.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

OPPORTUNITIES FOR IMPROVING MANAGEMENT

OF THE NAVY'S AEGIS CRUISER

The Aegis weapon system is the antiair warfare weapon designed to protect the Navy's carrier battle groups from Soviet air- and sea-launched missiles. It is comprised of an advanced design radar and related hardware and software.

The Aegis ship combat system is a combination of the Aegis weapon system and missiles, launchers, and other components. Two systems have been procured for the Navy's newest cruisers, the CG-47 and -48. The Aegis cruisers are being constructed at the Ingalls shipbuilding facility at Pascagoula, Mississippi. Additionally, the fiscal year 1981 Defense budget provides procurement funds for two more Aegis equipped cruisers, CG-49 and -50.

AEGIS SYSTEM DEVELOPMENT

The Aegis system has been developed by the RCA Corporation which began the Aegis development program in December 1969 and should complete the Aegis combat system integration program in early 1981. During the past 11 years, a partial Aegis system has been tested at sea, aboard U.S.S. Norton Sound, and at a land-based facility in Moorestown, New Jersey. Although a complete Aegis weapon system will not be operated until the first Aegis equipped cruiser is launched, Navy and RCA officials profess confidence that their actual live tracking and simulator-assisted tests provided proof that the Aegis antiair warfare weapon system will be capable against the existing and currently foreseen threat.

Although the Navy contends that the Aegis weapon system will be most capable, serious questions surround the supply support aspects of its operational availability.

The supply support policy planned for the Aegis weapon system will not insure that the system reaches its maximum operational availability. The Navy plans to use their standard supply support methodology, the Fleet Logistic Support Improvement Program, even though other methodologies have been proven to be better for the Aegis system. None of the analyses conducted by the Navy or the prime contractor considered the entire system, rather, each report examined only subsystems of the Aegis weapon system.

CG-47 PROGRAM

The conventionally powered CG-47 cruiser is being constructed using the same hull, propulsion, and mechanical components as employed on DD-963 class ships. As a result, the Navy expects few problems with these proven components. However, due primarily to the placement of the Aegis weapon on a DD-963 hull, much of the weight allowance for planned weapon systems has been consumed.

The Aegis radar system is the most powerful of the CG-47 sensors. This system is the Nation's most advanced shipboard air search sensor providing location and targeting information to destroy airborne threats. However, the CG-47 will have another air search radar system known as the SPS-49. The SPS-49 radar has some shortcomings and is not an adequate backup for the AEGIS SPY-1 radar. Therefore, retaining the SPS-49 radar system is highly questionable. Project office officials and program sponsors disagree, however, and contend that the SPS-49 provides a useful function and enhances operational flexibility. However, the long-range surveillance function can be performed by the Aegis radar system in a superior manner.

To insure that the CG-47's many systems operate effectively, a stable source of power is required. Therefore, great importance is associated with the operating characteristics of the ship's solid state frequency converters. Two contractors have proposed converters to supply power for the many systems on the CG-47 class ship. However, before either system had completed technical testing, the Aegis cruiser project office was required to select a unit for the first ship in this class, CG-47. Although project office officials cautioned that this was not a decision for the entire class, we believe that there will be little incentive to consider other converters for future ships once logistic and supply channels have been established.

The CG-47 will be a fully equipped ship with little or no room for future weapons and electronic systems. Given this situation, it is doubtful that the CG-47 will be able to accept new systems planned for this ship class.

The first Aegis antiair warfare system is scheduled for deployment in 1983, nearly 14 years after its development program began. Each fully equipped CG-47 class cruiser will cost in excess of $1 billion and 18 are planned for the fleet in the next 10 years.

The Selected Acquisition Report for this program does not provide full disclosure to the Congress of the status of important weapon systems planned for the CG-47.

CONCLUSIONS

The Nation has invested much in the capabilities of the Aegis weapon system. Yet, serious questions surround its readiness to support naval carrier battle groups. In addition to the Aegis SPY-1 radar, the CG-47 will be equipped with the SPS-49, a radar that does not appear to add capability commensurate with its weight and cost. Furthermore, this ship provides an inadequate margin for growth required by Navy standards. Additionally, controversy surrounds procurement practices for a component of the CG-47 and its Selected Acquisition Report could be improved.

RECOMMENDATIONS

To improve the effectiveness of the CG-47 Aegis cruiser, GAO recommends that the Secretary of Defense direct the Navy to:

--Evaluate how various supply support methodologies affect the availability of the entire Aegis weapon system. If methodologies other than the presently adopted Fleet Logistic Support Improvement Program system can provide significantly greater system availability at about the same cost, they should be selected for implementation on the Aegis system.

--Reexamine the need for the SPS-49 on CG-47 class ships to determine that its benefits are commensurate with its weight and cost.

--Insure that Defense Acquisition Regulations are followed in the decision for procuring power converters for the CG-48 and subsequent ships in this class.

--Emphasize weight reduction efforts and carefully monitor the effect of future systems, such as the Vertical Launching System, on the ship's weight and stability.

GAO also recommends that the CG-47 Selected Acquisition Report identify the status of important weapon systems that are scheduled to be deployed on this multimission ship. If critical systems will not be available on time, such limitations in the ship's capability should be reported to the Congress.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

ISSUES AFFECTING THE NAVY'S ANTI-SHIP CRUISE MISSILES

The Navy, to meet existing and projected threats from enemy surface ships armed with long-range missiles, has three antiship cruise missiles in various stages of development. These missiles are designed to provide the Navy with a standoff capability against enemy ships.

The missiles under development are the Harpoon, the Tomahawk Antiship Missile (TASM), and the Medium Range Air-to-Surface Missile. The Harpoon is deployed on surface ships and on submarines and can be launched from aircraft. It has a range of about 60 nautical miles and a program unit cost of about $886,000. TASM is being developed to be launched from surface ships and submarines. It has an operational range of about 250 nautical miles and a program unit cost of about $4.4 million.

SIGNIFICANT ISSUES THAT NEED TO BE ADDRESSED IN THE TASM PROGRAM

TASM may be approved for production in December 1981. However, a number of basic issues should be resolved before that date. Continuing TASM should depend on considerations, such as mission need, expected operational performance, and effectiveness. Issues which should be considered are:

--The mission need for TASM has never been officially approved and the threat is relatively low.

--The TASM system's utility could be adversely affected by large decreases in approved quantities, possible salvo firing requirements, and lowered operational requirements.

These factors should be carefully considered and reevaluated to determine whether TASM is likely to fill a priority need. These matters are particularly important now that the production decision for submarine-launched TASMs is scheduled for December 1981.

AN ASSESSMENT OF NAVY'S OVER-THE-HORIZON TARGETING EFFECTIVENESS IS NEEDED

To effectively use its long-range antiship missiles, the Navy needs to accurately detect, classify, and target over-the-horizon ships. Such a capability exists, but the Navy's evaluation of 1978 tests and fleet exercises showed that its current over-the-horizon detection, classification, and targeting (OTH-DC&T) capabilities is seriously limited.

All subsystems of the OTH-DC&T system are limited to varying degrees. Especially weak are ship identification and battle damage assessment. Since fleet ships and submarines are not equipped to perform OTH-DC&T, Harpoon and TASM OTH-DC&T must be done by combining onboard sensors, remote sensors, or undedicated and scarce fleet aircraft resources.

Improvements are being tested and evaluated, and some Navy officials believe a capability acceptable to the Defense Systems Acquisition Review Council will be demonstrated for submarines by the scheduled TASM production decision in December 1981. Assessments of OTH-DC&T capability have been made and corrective actions have been instituted. However, an assessment of the likelihood of adequate over-the-horizon effectiveness over a range of the most probable scenarios and the resulting contribution to or limitation of TASM success, particularly in crisis or wartime conditions, has not been made. Such information is essential for making a production decision on TASM.

Demonstrating an acceptable OTH-DC&T capability by December 1981 will be a formidable task because of restrictive requirements (e.g., minimize use of new and dedicated systems) and the technical difficulties and funding restrictions which exist. Testing and evaluation lacks specific criteria for success, is conducted in a structured environment, and is highly dependent on scenarios.

REDUCTION IN MISSILE QUANTITIES AND OTHER ISSUES AFFECTING OPERATIONAL EFFECTIVENESS

Quantities of Harpoon and TASM being procured or planned for procurement are significantly less than the needs estimates. The operational capability of the two weapon systems could be seriously limited particularly since more, rather than fewer, will probably be needed for salvo tactics (firing several at one time) which the Navy is developing.

Currently, the fleet has a shortfall of Harpoon missiles, and a shortfall is also anticipated at program completion in fiscal year 1984, if current procurement plans prevail. High level Navy officials are critical of the shortages because fleet readiness is impaired.

Readiness of the Harpoon missile is impaired because the required logistics support has not been fully provided. During Harpoon development, more emphasis was given to producing a missile for service use and not enough was given to logistics support. As a result, although Harpoon received provisional approval for service use in 1975, deficiencies still exist in areas such as training, maintenance, spares, and documentation needed to support the system. The Navy believes that logistic shortfalls have been identified and efforts are being made to resolve them.

RECOMMENDATIONS TO THE SECRETARY OF DEFENSE

GAO recommends that the Secretary of Defense direct the Navy to:

- --Specifically define the TASM mission and the Soviet threat and consider TASM utility in light of the large decreases in approved quantities, possible salvo firing requirements, and lowered operational requirements.

- --Establish test criteria for evaluating the OTH-DC&T capability and conduct an assessment of its available capability simulating a more realistic environment using the most likely scenarios in which antiship cruise missiles will be needed.

- --Determine whether Harpoon and TASM can be effective against the threat with the reduced procurement quantities, particularly in view salvo firing tactics being developed.

- --Require that logistic support be given greater emphasis so that Harpoon readiness will be improved.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

F/A-18 NAVAL STRIKE FIGHTER: PROGRESS HAS BEEN MADE BUT PROBLEMS AND CONCERNS CONTINUE

The F/A-18 strike fighter is planned to replace such aircraft as the A-7, A-4, and F-4, presently used by the Navy and Marine Corps for fighter and light attack missions. This twin-engine aircraft is to be based on aircraft carriers and is to perform such missions as strike escort, fleet air defense, interdiction, and close air support.

Both the Congress and the executive branch have expressed concern over the F/A-18's cost and performance. Many of these issues were raised in GAO's February 14, 1980, report on the program.

Program cost estimates continue to increase. Although there has been other cost growth, inflation and quantity changes have been the major reasons for cost estimate increases since the development estimate was established in 1975. Furthermore, current estimates of total program cost vary from $29.7 billion to $41 billion depending on the assumptions used, such as differing build-up rates for production. These estimates are based on escalation rates prescribed by the Office of the Secretary of Defense, which are considerably lower than those projected by industry. If actual escalation rates continue to be higher than rates used by the Department of Defense, program cost estimates will continue to be understated.

The Navy and contractors continue to work on technical problems discussed in GAO's February 1980 report. These include the computer systems' software, the air turbine starter, oil temperature, bulkhead failures, and manufacturing processes. Improvements have been made on some of the problems such as the manufacturing process for the hybrid chips used in the radar.

GAO's February 1980 report also addressed deficiencies in acceleration and range, which are still below threshold levels. However, a Department of Defense F/A-18 review group has concluded that the demonstrated acceleration and range are acceptable and that acceleration at some speeds is impressive.

During 1980, a roll-rate performance problem was identified, a fuel cell leakage problem reoccurred, and two F/A-18s crashed. The roll-rate problem was reported by the Navy in February 1980 and has required extensive engineering work to modify the aircraft's wings. Flight testing is underway to evaluate whether the problem has been corrected and to determine the effect of the correction in other performance areas. (See pp. 9 and 10.) The fuel cell leakage problem has caused delays in the flight test program and has adversely affected reliability and maintainability.

In September 1980, a development aircraft crashed in England because of a failure in the low-pressure turbine in one of its F404 engines. The cause of the turbine failure is not yet known but is being investigated.

Another crash occurred on November 14, 1980, during an initial operational test and evaluation exercise at Patuxent River, Maryland. An investigation is also taking place on the cause. According to Navy officials, the aircraft entered into a spin while practicing air combat maneuvers, and the pilot was unable to regain control.

Reliability and maintainability experience has continued to improve even though problems are being encountered with subsystems, such as the fuel system, mission computer, air turbine starter, and built-in test. For example, the F/A-18's maintenance concept is based on satisfactory operation of built-in test. However, built-in test is not yet capable of providing maintenance and failure information necessary to adequately support aircraft maintenance. (See pp. 22 and 23.) Nonetheless, Navy officials expect the F/A-18 to represent a major improvement in the areas of reliability and maintainability when it enters the fleet.

GAO believes that development of the F/A-18 is at the stage where the following issues should be considered in development and production decisions:

--Whether the modifications to the wing will correct the roll-rate problem without adversely affecting other performance areas.

--Whether the modifications to the bulkheads are adequate.

--Whether the high-oil temperature condition can be corrected.

--Whether the built-in test objectives can be achieved.

--Whether the fuel cell leakages can be corrected.

--Whether the causes of the accidents can be corrected to assure safe flight conditions and operational effectiveness.

RECOMMENDATIONS

GAO recommends that during fiscal year 1982 budget hearings, the Secretary of Defense should

--identify the development, production, and operational risks associated with the outstanding technical problems;

--identify the production cost estimates associated with higher and lower production quantities than requested for fiscal year 1982 including the most efficient and economical production rate; and

--provide a program cost estimate based on realistic inflation rates.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

CHAPTER 4

AIR FORCE PROGRAMS

Progress has been made during the first year of full-scale development of the MX weapon system--particularly in missile development. The Department of Defense, however, is faced with a tremendous management challenge in directing and coordinating several parallel efforts involving the missile, ground systems, facilities, and land withdrawal issues. Achievement of cost, schedule, and performance goals will be difficult because:

--New requirements could increase costs by about $700 million (1978 dollars). Costs could be increased further when system requirements are finalized, developmental specifications are completed, and force size is determined.

--Performance requirements for development of many ground mechanical and electronic systems have not yet been finalized.

--Slippages in some milestones may impact on obtaining land for MX, thus increasing the risk of not meeting the initial deployment date.

Air Force program office estimates indicate that the cost to develop, acquire, and operate MX until the year 2000 will be about $34 billion (1978 dollars). This includes the new requirements discussed above. With Defense inflationary adjustments, this estimate increases to about $70 billion. The estimate does not include the Department of Energy costs for warhead development, acquisition, and maintenance.

Although Defense has approved new requirements estimated to cost $700 million, there has been no change in the life-cycle cost estimate. Defense stated that every effort will be made to offset cost increases by cost reductions in other areas.

MX costs could increase substantially by force size expansion, split basing, incorporating all-weather capability, and adding a survivable two-way direct communication capability.

MX is designed to provide a certain number of surviving reentry vehicles assuming a threat constrained by the unratified Strategic Arms Limitation treaty. Without a treaty, the Soviets could build enough weapons to neutralize MX. MX could then be expanded to counter that threat--at considerable cost--by adding missiles, shelters, and/or a ballistic missile defense. The Congress should be aware that it is not possible at this time to predict the ultimate size of the deployment area, the number of missiles and shelters, or the cost of MX.

The primary method of Strategic Arms Limitation treaty verification should prevent undetected deployment of additional missiles. Some of the additional verification features in the MX design--especially the view ports--appear unnecessary.

The Air Force's Strategic Air Command assessed existing military bases in Nevada and Utah and concluded that neither land nor facilities were available for an MX operating base. However, excess land at Nellis Air Force Base was not included in the assessment. Further, consideration was not given to placing part of the facilities on existing bases.

The Air Force is considering options that would enhance its ability to take actions that may be necessary to protect location uncertainty. Some of these options could be construed as restrictions on public access or activities, but no final decisions have been made. This issue should be resolved so the full implications of public access can be addressed in congressional deliberations on the legislation to withdraw land for MX deployment.

GAO recommends that the Secretary of Defense:

- --Restudy the need for MX verification features. The results of this study should be provided to the Congress, along with information previously requested by the Congress on the cost of view ports.

- --Have an independent assessment made and inform the Congress of the feasibility of placing one of the operating bases on excess Federal land at Nellis Air Force Base. If not feasible to locate an entire MX operating base at Nellis, the potential for siting some MX facilities at existing military bases should be examined.

- --Inform the Congress of how the Air Force will enforce measures to assure the preservation of location uncertainty, including an identification of any new laws or changes to existing laws that may be required.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

DOD PARTICIPATION IN THE SPACE TRANSPORTATION SYSTEM: STATUS AND ISSUES

The operational availability of the Space Transportation System has been delayed 3-1/2 years. Delays have resulted from identification of new requirements, funding constraints, and development difficulties with the system.

While the delays have had several effects on Department of Defense (DOD) participation in the program, to date there has been no known operational degradation in DOD space capabilities. However, the cost of DOD's participation in the program has grown from about $1.2 billion to about $2.8 billion--an increase of $1.6 billion (133 percent)--between fiscal years 1978 and 1982. This increase does not reflect the total growth in the cost of DOD's participation in the program.

Continuing uncertainties may further delay DOD's use of the full capabilities offered by the system, increase costs, or degrade future DOD operational capabilities in space.

The system consists of the Space Shuttle (four orbiters each with a large external propellant tank and two solid rocket motors); upper stages to transfer payloads from the Shuttle's low Earth orbits to higher orbits; Spacelab for conducting experiments in space; launch and landing facilities and associated ground support equipment; and simulation, training, and mission control facilities necessary for operation. The aircraft-like orbiters and the solid rocket motors are reusable components; the external tank is expendable.

The National Aeronautics and Space Administration (NASA)/DOD program to develop the Space

MASAD-81-6
Feb. 28, 1981

Transportation System is closely intertwined, and problems in meeting performance goals or milestones by one agency will affect the other. For example, NASA delays in meeting operational dates caused DOD to procure more expendable vehicles than originally planned and delay transitioning of military payloads from expendable launch vehicles--such as the TITAN III--to the Space Transportation System.

Because of difficulties in obtaining information from the Air Force and a tight reporting deadline, GAO is not sure it has the most current and complete cost data on the program.

DELAYS AT VANDENBERG LAUNCH AND LANDING SITE

The operational date of launch and landing facilities being built at Vandenberg Air Force Base has been delayed 1-1/2 years from December 1982 to June 1984. System program office officials said the June 1984 date was high risk and virtually impossible to meet. They believe a more achievable date is October 1984.

SECURE COMMUNICATION NEEDS

For classified missions, DOD needs secure communication lines between Vandenberg Air Force Base and Kennedy and Johnson Space Centers and secure lines between Johnson and NASA's Telemetry and Tracking Center at Goddard Space Flight Center, Maryland. Further, full use of the Space Shuttle's capabilities is dependent upon availability of the NASA Tracking and Data Relay Satellite System, which has slipped from December 1980 to April 1983. If this system is not available by April 1983, then alternate secure command, control, and communications routes must be developed to support the first classified operational launch. Program officials are studying "work-around" solutions and the need for additional secure communications lines. Accordingly, the potential effects on operational dates and costs are not yet known.

UNCERTAIN AVAILABILITY OF INERTIAL UPPER STAGE

The Inertial Upper Stage development program has experienced difficulties in achieving its required capabilities. As a result, the initial operating capability has slipped 1 year from July 1980 to July 1981 and program costs have increased from $284.5 million to $386.6 million in 1978 dollars.

Major factors in the delays and cost growths were the main contractor's underestimating the technical complexity of the Inertial Upper Stage and inadequate management attention by the contractor and the Air Force. These problems led the Air Force to renegotiate the contract for development and production of nine Inertial Upper Stages and place a ceiling of $462.4 million on the contract. This is not a maximum ceiling since it is subject to increase with changes in the scope of work. As of September 1980, additional modifications increased the contract amount to $471.8 million.

In September 1980 the Air Force reported to the House and Senate Military Construction Subcommittees that Inertial Upper Stage development was on schedule and would support operational requirements. In GAO's opinion, however, areas of major uncertainty exist. Motor development efforts still are experiencing difficulties, software will not be completely checked out until early 1982, and there is a possibility the airborne support equipment may have to be redesigned. The first two areas of concern could delay the first TITAN/Inertial Upper Stage launch scheduled for November 1981. The third area could delay the first Space Shuttle/Inertial Upper Stage launch scheduled for September 1982.

POTENTIAL NEED FOR CONTINUED USE OF EXPENDABLE VEHICLES AND/OR MORE ORBITERS

Recent comments by the Secretary of the Air Force and top NASA officials, as well as studies conducted by NASA and an Air Force contractor, indicate continued use of expendable launch vehicles and/or more orbiters may be required. GAO was advised that funds for a fifth orbiter are expected to be included in the NASA fiscal year 1982 budget.

In view of past problems with the Space Transportation System, continuing uncertainties, and the lack of operational experience with the system, it is essential that the Congress have a comprehensive understanding of the options available for meeting launch requirements--particularly critical DOD requirements.

RECOMMENDATIONS

The Secretary of Defense should provide the Congress information on the total cost of DOD participation in the program, including those costs funded by individual satellite and other programs.

Further, the Secretary of Defense and the NASA Administrator also should provide the Congress with comprehensive information on the options being considered for maintaining an assured launch capability for defense and civil missions and the key assumptions, costs, and risks associated with each option. The study should identify all known and projected critical and noncritical missions and the advantages and disadvantages of continuing use of expendable launch vehicles and/or increasing the number of orbiters. Information should also be provided on probable effects of delaying or canceling some noncritical flights until operational experience with the Space Transportation System is obtained.

AGENCY COMMENTS

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of the report was discussed with high level DOD and NASA officials associated with management of the program to assure that the report is accurate and complete.

Though not solicited, NASA provided GAO with written comments. (See app. II.) NASA disagreed with the draft report in general and with the conclusions and recommendations, particularly because NASA officials believed the report implied that DOD's difficulties were due solely to NASA's delays. GAO clarified the report to point out that NASA contributed but was not the sole cause of problems with the program.

THE F-16 PROGRAM: PROGRESS, CONCERNS, AND UNCERTAINTIES

The F-16 was conceived as the "low" element in a "high/low" concept of mixing high performance, costly aircraft (the F-15) with greater numbers of simpler, less expensive aircraft (the F-16). It eventually evolved into a multimission aircraft to replace the F-4 aircraft. It is being developed in a cooperative undertaking between the United States and four European North Atlantic Treaty Organization countries. The current program provides for coproduction of 998 aircraft--650 for the United States and 348 for the European countries. Other countries have bought or are considering buying the F-16. Moreover, the U.S. F-16 program now calls for an additional 738 aircraft. The program cost estimate is about $18.7 billion.

The F-16 program is generally progressing on schedule and meeting performance requirements. Its current program cost estimate per aircraft of $6.4 million (fiscal year 1975 dollars) is within its estimate of $6.7 million (fiscal year 1975 dollars). Moreover, the operational commands are satisfied with the aircraft's performance, and its mission capable rates have met or exceeded Air Force expectations. However, technical, operational, and program concerns and uncertainties exist. Those involving classified data have been omitted from this digest. (See pp. 12 to 15, 17 to 25, and 27 and 28.) Others are described below:

--Provisions are now being built into the F-16 to allow for future improvements which would transform it into a more expensive and sophisticated weapon system to meet perceived mission needs into the 1990s. Two different configurations are being considered--a "swing" aircraft for air-to-air and air-to-surface missions and a missionized air-to-surface aircraft. Approval of this change followed years of disagreement within the Department of Defense over what capabilities the F-16 should have. If the actual transformation takes place, it would be a change to the original F-15/F-16 high/low mix concept. (See pp. 7 to 10.) GAO believes that in view of the increased capability that would result if the improvements are made, Defense should provide justification to the Congress for the total number of F-16s and the number of differently configured F-16s that it believes are required. (See pp. 14 and 15.) GAO also believes that the policy set forth in the Office of Management and Budget (OMB) Circular A-109 for approving mission needs and identifying and exploring alternative solutions could and should be applied in a broader sense to the needs being addressed by the planned improvements.

--Risk and uncertainty exists regarding the improvement efforts which are being considered. Planned improvements for the missionized air-to-surface configuration may exceed the F-16's currently available cooling capacity. The currently available space may be adequate to incorporate the planned improvements for each configuration, but allows little room for growth for the missionized air-to-surface configuration. Other uncertainties regarding the improvements involve classified data.

--The F-16 achieved its initial operational capability on schedule, but future site activation dates have been stretched out because production rates were reduced.

The F-16 program cost estimate has increased from $6.1 billion to $18.7 billion primarily due to a twofold increase in the quantity of aircraft to be acquired, higher than anticipated inflation, and a planned reduction in future production rates. Incorporation of planned improvements would further increase program costs.

RECOMMENDATIONS

We recommend that the Secretary of Defense:

--Provide to the Congress in the Air Force's budget hearings an assessment of the cost, risk, and impact on F-16 logistics support that the F-16 improvements will have, if incorporated.

--Provide justification to the Congress for the total number of F-16s and the number of differently configured F-16s that would be required if the improvements are incorporated as now planned.

--Inform the Congress as to the current and expected effect on the U.S. F-16 program of the foreign military sales to Israel and Egypt.

--Direct that mission element need statements be drafted, based on mission analyses at broad mission levels (including the Air Force and the Army contributions), to establish a Defense-wide position on the mission deficiencies being addressed by the planned improvements for the F-16 and other aircraft.

--Review the above mission element need statements and either (1) formally identify the improvements as the accepted approaches to satisfy the mission deficiencies or (2) direct that other possible solutions be solicited and given adequate consideration in accordance with OMB Circular A-109.

GAO's August 20, 1980, report on F-16 integrated logistics support (see app. I) contained recommendations in such areas as underfunded war readiness spares, technical orders, uncertain depot-level repair capability, and problems with deploying automatic test equipment. The Air Force actions on the recommendations in that report are still pending.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program, and a draft was submitted to the European countries participating in the multinational F-16 program to assure that the report is accurate. Their points of view are included where they differ with GAO's. For example, officials of General Dynamics--the prime contractor--disagreed with GAO's concern about the difficulty in achieving and sustaining a high level of readiness as more F-16s are deployed. (See p. 44.) Some of their comments, however, either objected to the tone of the draft report or provided explanatory data which, in some cases, did not warrant inclusion in the report.

THE DEPARTMENT OF DEFENSE SHOULD RESOLVE CERTAIN ISSUES CONCERNING THE C-X AIRCRAFT BEFORE REQUESTING PROPOSALS FROM INDUSTRY FOR ITS FULL-SCALE ENGINEERING DEVELOPMENT

Our review of the C-X aircraft program addressed major issues concerning the aircraft's range and its load carrying capability. In addition, Defense has not yet completed its strategic mobility requirements study as directed by the House and Senate Authorization Act for fiscal year 1981 nor has a Mission Element Need Statement (MENS) been approved. Nevertheless, the Air Force plans to solicit formal design and cost proposals from potential contractors in the immediate future for the full-scale engineering development of the C-X aircraft. We believe such action before these matters are resolved is both premature and contrary to the sound acquisition management principles of Office of Management and Budget Circular A-109.

BACKGROUND

In November 1979 the Air Force formed a task force with Army and Marine Corps participation to define future airlift requirements for the worldwide deployment of U.S. forces. The task force analysis revealed significant shortfalls in the capability of the United States to provide long-range intertheater airlift to meet worldwide rapid mobility requirements. In addition, the task force recognized that the United States does not currently have the capability to airlift large outsize cargo, such as the Army's XM-1 main battle tank and infantry fighting vehicles, within a theater (intratheater).

The task force recommended the acquisition of an airlift aircraft with adequate size and range to carry outsize cargo intertheater and also with the capability to land at small austere airfields. The small austere airfield landing capability would reduce potential aircraft saturation at larger airfields and would allow the aircraft to be used in an intratheater role.

To meet these requirements the Air Force has proposed the C-X, an aircraft which can carry larger loads than the

C-141 but about half as much as the C-5. Full-scale production of the C-X could begin about October 1986 with an initial operational capability in September 1987. The Air Force estimates that a procurement of 200 C-X aircraft could cost about $10 billion to $11 billion (fiscal year 1980 dollars) for development and production.

The Air Force is planning to issue requests for proposals (RFPs) to potential contractors for the full-scale engineering development of the C-X aircraft. If the RFPs are issued in October 1980 as planned, source selection could begin in January 1981.

C-X RANGE AND LOAD CAPACITY MAY BE INADEQUATE

The current design range of the C-X may be inadequate unless substantial refueling is provided at intermediate land bases or by aerial refueling. In addition, proposed modifications to the Army's XM-1 main battle tank could increase its total combat weight to over 130,000 pounds, the C-X's maximum load capacity.

Current C-X design range may be inadequate

In certain contingencies, the range of the C-X may not be adequate to reach its destination without refueling. There is some question, however, as to whether sufficient aerial or land-based refueling will be available to meet C-X requirements. In a Persian Gulf conflict, for example, the most likely route for the C-X would be from the Eastern United States to Lajes Air Base in the Azores; then to Cairo, Egypt; and then to Dhahran, Saudi Arabia. The distances involved are 2,295, 3,155, and 1,170 nautical miles, respectively. With a design range of 2,400 nautical miles while carrying a maximum load, the C-X could not travel from Lajes to Cairo without refueling. If the C-X carried only 75 percent of its maximum load (97,500 pounds), its range would be increased to 3,200 miles and refueling may not be necessary. However, both the XM-1 and the M-60 main battle tanks exceed 75 percent of the C-X's maximum load. Therefore, the C-X could not carry these tanks that distance without refueling.

Although the Air Force plans to equip the C-X for aerial refueling, Air Force studies indicate the tanker capability of the United States may already be inadequate for some contingencies involving both strategic and tactical forces. With the addition of the C-X to the airlift force, there will be an even greater demand on limited tanker resources. Therefore, adequate aerial refueling may not always be available to the extent required by the C-X.

The C-X could rely on alternate land-based refueling stops in Europe or the Mediterranean to carry its maximum load to the Persian Gulf area. In the 1973 Middle East war, however, the United States could not obtain diplomatic clearance to use bases which the United States normally used in the United Kingdom, Spain, Italy, Greece, and Turkey. Also in 1973, the aircraft had to avoid flying over land masses and stay out of airspace controlled by Arab countries. With the growing political and economic influence of third world countries, the availability of en route refueling locations in the future may be denied, as was the case during recent attempts by the United States to deploy fighters to Egypt and to deliver F-16s to Israel.

In contingencies other than the Persian Gulf, the C-X would also require refueling. For example, in a European conflict the C-X could not travel from the Eastern United States to central Germany without either aerial refueling or one land-based refueling stop. In a Korean conflict, the C-X with maximum load would require three land-based refueling stops, or a combination of aerial refueling and land-based stops.

An alternate airlift plan could employ the C-5 to carry XM-1 and M-60 tanks while the C-X carried lighter cargo to extend its range. Although this would be possible, it might also create additional intratheater airlift requirements because the C-5 cannot land at the small austere airfields that are planned for C-X operations. Therefore, the tanks would have to be moved intratheater with the C-X from the large C-5 airfields to the battle area. C-X aircraft tasked for this purpose would then be unavailable for intertheater airlift purposes. Also, this tactic would increase aircraft traffic at the large airfields and contribute to airfield saturation.

C-X maximum load capacity may be inadequate to carry the XM-1 tank

The potential future weight growth of the Army's XM-1 main battle tank may make it too heavy to be carried on the C-X. The XM-1 currently weighs about 120,000 pounds, including fuel and ammunition. The Army has approved modifications to the tank, including the addition of the 120-mm. gun which will increase its combat weight to about 123,000 pounds and has proposed other modifications which could increase the tank's weight to a maximum of 134,200 pounds. This weight would exceed the maximum load capacity of the C-X by 4,200 pounds.

The XM-1's weight could be reduced about 7,000 pounds by unloading its fuel, ammunition, and machine guns. Although this would reduce the tank's weight below 130,000 pounds, we were told that the Army prefers the tanks to be combat ready when delivered to small austere airfield locations. We were also told that future modifications may become necessary to meet changing threats or to correct deficiencies and that these modifications could increase the tank's weight to over 130,000 pounds even without fuel and ammunition.

DEFENSE MOBILITY STUDY MAY AFFECT C-X DESIGN

Although Defense has not yet completed a study of the mobility requirements which could affect the design of the C-X aircraft, the Air Force is continuing with its plans to issue RFPs to potential contractors for its full-scale engineering development. As you know, the House and Senate Committees' Authorization Act for fiscal year 1981 has directed Defense to conduct a comprehensive study of the mobility requirements for United States military forces. Although the committees believe there is a need for additional strategic airlift capability, it is uncertain as to whether the C-X concept proposed by the Air Force is the best way to provide this added capability.

Defense's mobility study is intended not only to determine total airlift requirements, but also to form the basis for the design of suitable new aircraft or derivatives of existing aircraft, to meet the requirement. Although the results of this study will not be reported to the committees until February 1981, the Air Force plans to issue RFPs about October 15, 1980.

By issuing RFPs several months before the mobility study is completed, the Air Force may be requesting an aircraft design that is not fully compatible with the needs indicated by the study results. This would require the Air Force to revise and reissue RFPs and solicit new proposals from the contractors. This effort could cost the contractors several million dollars which would be shared in part by the U.S. Government through the allocation of overhead to Government contracts.

A C-X MENS SHOULD BE APPROVED

We are also concerned that the Air Force apparently plans to release C-X RFPs prior to the Secretary of Defense's approving a MENS. Although we were unable to obtain the Office of the Secretary of Defense's informal comments on the draft

MENS, we understand some controversy exists within Defense over the cost effectiveness of procuring a C-X with both intertheater and intratheater capabilities. Because this issue could have a significant impact on the design and cost of the aircraft, we believe that the Air Force should not issue RFPs until a C-X concept has been agreed upon and a MENS is approved.

CONCLUSIONS AND RECOMMENDATIONS

The Air Force is planning to request cost and design proposals from potential contractors for the full-scale engineering development of an aircraft which may not have the range or load carrying capacity to meet mission requirements. In addition, because Defense has not completed its mobility requirements study and the C-X MENS has not been approved, the Air Force may be requesting an aircraft design that is not compatible with the mobility study results or the concept as agreed upon by the Office of the Secretary of Defense and stated in the MENS.

We recommend that you direct the Secretary of the Air Force to delay issuing C-X RFPs or proceeding further with the C-X program until the Air Force resolves the aircraft's range and load limitations and until the mobility requirements study is completed and a MENS is approved. We believe these actions would provide sound management to an acquisition program that currently contains uncertainties and could undergo substantial changes when these uncertainties are resolved.

MAJOR ISSUES CONCERNING THE C-X RANGE AND PAYLOAD REMAIN UNRESOLVED

Our review of the C-X aircraft program addressed major issues, including the aircraft's limited range and load carrying capabilities. We summarized these issues in a letter to the Secretary of Defense, dated October 10, 1980, which recommended that the Air Force delay issuing requests for proposals to industry for the aircraft's full-scale engineering development until these issues were resolved. The Principal Deputy to the Under Secretary of Defense, Research and Engineering (USD/R&E) did not fully agree with our assessment of the C-X. He stated that the minimum acceptable range and load carrying capabilities of the C-X are adequate to meet the intertheater airlift requirements. As a result, on October 15, 1980, the Air Force requested proposals from industry for C-X full-scale development. Our October 10, 1980, letter and the USD/R&E response are included as enclosures I and II, respectively.

The Air Force has now begun to evaluate proposals received from three major contractors and plans to award a development contract for the C-X in July 1981 if the program is approved by the Defense Systems Acquisition Review Council and if congressional funding is authorized. Full-scale production of the C-X could begin about October 1986, with an initial operational capability scheduled for September 1987. The Air Force estimates that the program could include about 200 aircraft at a cost of $10 to $11 billion (fiscal year 1980 dollars) for development and production.

We believe that the C-X range and payload issues discussed in our October 10, 1980, letter warrant further consideration, especially the range and payload requirements for the C-X. We still believe that the Air Force is specifying a C-X design which is sacrificing the aircraft's primary mission of intertheater airlift to achieve a greater capability to operate within a theater on small, austere airfields (intratheater).

The Air Force requested contractors to propose an aircraft designed to meet or exceed certain minimum performance specifications and which could best complete the airlift requirements of four airlift scenarios described in the requests for proposals. Air Force officials believe this approach will provide the best aircraft design to meet the intertheater airlift mission. However, because three of the four scenarios emphasize the capability to operate on small, austere airfields, we believe the C-X design envisioned by the Air Force may not provide the optimum solution to meeting the primary requirement of intertheater airlift as stated in the C-X Mission Element Need Statement (MENS). Accordingly, we are providing a summary of our initial conclusions concerning the range and payload of the C-X, the USD/R&E's response to these conclusions, and our observations on other C-X performance issues.

C-X HAS LIMITED INTERTHEATER RANGE AND PAYLOAD CAPABILITIES

We concluded in our October 10, 1980, letter that the minimum specified range and payload of the C-X may be inadequate unless substantial refueling is provided at intermediate land bases or by aerial refueling. Also, we noted that there is a question as to whether sufficient land-based or aerial refueling will be available to meet C-X requirements.

USD/R&E response

The reply to our letter stated:

> "The C-X with full payload will need aerial refueling or intermediate stops to reach NATO [North Atlantic Treaty Organization], Korea, or the Persian Gulf with maximum payload, as do the C-5 and C-141. * * * It is important to realize that only a very large aircraft would be completely free of the need for aerial refueling or enroute basing when carrying its maximum allowable payload. * * * It is important to note that roughly only 10 percent of the missions flown will carry the maximum payload. The average payload is closer to 70 percent of maximum because of typical load volume/densities. * * *"

Our additional observations

We agree that intertheater airlift aircraft would require about the same number of refueling stops or aerial refuelings as the C-X to reach a NATO, Persian Gulf, or Korean conflict with maximum load. However, the maximum load of a large intertheater aircraft would be about twice as much as the maximum load of a C-X designed with the minimum performance specifications established by the Air Force. Further, a larger aircraft could trade off part of its cargo for more fuel and achieve a much greater range than the C-X, while still carrying more cargo than the C-X with its maximum load. For example, a larger aircraft could carry about 180,000 pounds of payload unrefueled from the Eastern United States to central Germany. This could include an M-1 tank and about

50,000 to 60,000 pounds of additional cargo. The C-X, however, could not travel the same distance unrefueled unless its cargo was reduced to about 80,000 to 90,000 pounds, or about one-half that of the larger aircraft. Because M-1 and M-60 battle tanks weigh more than 90,000 pounds, the C-X could not carry this equipment to central Germany without refueling.

The USD/R&E stated that only about 10 percent of the C-X sorties would carry a maximum load and the C-X with its average payload (70 percent of maximum) would have adequate range to reach critical refueling bases enroute to the Persian Gulf or other scenarios. However, equipment which comprises a C-X maximum load, such as battle tanks, are essential to the war effort, and the C-X's ability to move this equipment to the battle area quickly could be crucial. In most scenarios, the limited range of the C-X with full payload, or even with 70 percent of full payload, would require one or more refueling stops which in turn would increase the delivery time. As discussed above, a larger aircraft designed more optimally for the intertheater mission could achieve much greater range than a C-X while carrying a greater payload. The larger aircraft would, therefore, require fewer refueling stops and could deliver more cargo to the battle area in less time--an advantage which is critical to support the rapid mobility concept.

The USD/R&E did not respond to our concern that land-based or aerial refueling may not be available to the extent required by the C-X. Throughout the past decade, the number of major overseas Air Force installations has steadily decreased, while use of the remaining bases has become subject to more stringent host nation conditions. As discussed in our October 10, 1980, letter, the United States could not obtain diplomatic clearance to use bases in European and Mediterranean area countries during the 1973 Middle East war and on more recent occasions. Because U.S. access to these bases has been denied in the past, we believe the future availability of these locations to support a Persian Gulf contingency is questionable.

If access to critical intermediate land bases were denied, the C-X could not travel to the Persian Gulf without extensive aerial refueling. In view of Air Force studies which indicate tanker aerial refueling assets are already inadequate in some contingencies, the U.S. tanker resources may not be able to support the increased demand for aerial refueling for C-X aircraft.

FUTURE CAPABILITY OF C-X TO CARRY THE M-1 TANK IS STILL UNCERTAIN

In our October 10, 1980, letter, we stated the potential future weight growth of the Army's M-1 main battle tank may make it too heavy to be carried on the C-X aircraft. This conclusion was based on data provided by the Army which indicated that a number of proposed M-1 modifications could increase the tank's weight to over 130,000 pounds.

USD/R&E response

The reply to our letter stated that:

> "The * * * load (130,000 lbs.) of the C-X was established in coordination with the U.S. Army to accommodate the M-1 tank. The M-1 currently weighs 120,800 lbs. (combat loaded). Future improvements being considered could increase its weight to 129,000 lbs. combat configuration if all improvements are approved. At this time only the addition of the 120 mm gun has been approved. Each product improvement program and the associated weight increase is being coordinated with the Air Force."

Our additional observations

The Army's recent reevaluation of the M-1's potential weight growth places the tank's maximum weight at 129,000 pounds (combat loaded) if all product improvements are implemented. Although this weight is within the C-X maximum payload, it allows only 1,000 pounds weight growth for future modifications to meet changing threats or to correct deficiencies. This is a small margin to assure that the C-X will retain its capability to carry the M-1 through the 1990s and beyond.

An Army official said they are now considering a plan which would cancel several proposed modifications and would limit the tank's maximum weight to about 126,000 pounds. This plan, if approved, would provide a 3-percent margin for future weight growth. Army officials also said they could reduce the tank's weight about 7,000 pounds by unloading its fuel, ammunition, and machine guns, although they prefer the tank to be combat ready when delivered to the contingency area.

OTHER OBSERVATIONS

In addition to the information discussed above and in our October 10, 1980, letter, we believe the following additional observations regarding C-X performance capabilities should be considered.

Although the Air Force has emphasized the need for an aircraft which can operate on airfields with short, narrow runways, a larger intertheater aircraft could also have some capability on small, austere airfields, such as the 4,000 feet specified for the C-X with maximum payload. Further, recent C-5 operational utility evaluation tests indicate that a large intertheater aircraft could taxi or unload cargo on unprepared surfaces, including sand, clay, and silt. A large aircraft, therefore, could taxi and park off prepared surfaces that had been surveyed and approved for these operations in advance and would not necessarily be precluded from using an austere airfield.

We also observed that while the C-X has been reported as needing the capability to operate on semiprepared surfaces such as sand or gravel, the model contract in the request for proposal did not require the contractor to test or demonstrate C-X capabilities on other than paved surfaces. The Air Force has stated that this capability is critical because over one-half the runways in the Persian Gulf area and many runways in other parts of the world are unpaved. Without actual contractor testing or demonstration, however, there is no assurance the C-X will be able to meet its minimum landing and takeoff performance specifications on semiprepared surfaces. On February 20, 1981, after discussing this matter with Air Force officials, the Deputy for Airlift and Trainer Systems said the model contract would be modified to require contractor testing of the C-X on semiprepared surfaces.

CONCLUSIONS AND RECOMMENDATIONS

Although the Air Force has emphasized the importance of procuring a C-X aircraft with the ability to use small, austere airfields, the C-X MENS states that "the feasibility of requiring this capability will depend upon the extent of its penalty to the primary mission, which is intertheater airlift." We believe the minimum range and payload specified for the C-X, while providing a small, austere airfield capability, may penalize the aircraft's primary mission of intertheater airlift.

We recommend that you reassess the range and payload issues discussed above and in our October 10, 1980, letter to determine if the C-X aircraft being considered by the Air Force provides the capability to fill the mission need as stated in the C-X MENS. Also, should you determine that a smaller aircraft is not appropriate, the proposal evaluation currently underway should be terminated and requests for proposals reissued on the basis of your reassessment.

THE DEPARTMENT OF DEFENSE SHOULD RESOLVE MAJOR ISSUES REGARDING REENGINING THE KC-135 AIRCRAFT BEFORE CONTINUING THE PROGRAM

Our review of the Air Force's KC-135 tanker aircraft reengining modification program shows that there are major issues regarding the program's pace, cost effectiveness, need, and affordability that should be resolved by the Department of Defense before any additional funds are committed to this multibillion dollar program. Although the program is in the early stages of full-scale development and meets all the criteria of a major system acquisition, it has not been designated a major system and subjected to review by the Defense Systems Acquisition Review Council (DSARC).

The purpose of our work was to determine program status and identify unresolved pertinent issues. We reviewed program documents, contracts, correspondence, and other pertinent records and information. We discussed the program with officials within the Office of the Secretary of Defense (OSD); Headquarters, United States Air Force, Strategic Air Command; Air Force Systems Command; and Air Force Logistics Command (AFLC).

BACKGROUND

Numerous studies have been made over the years to evaluate methods for modernizing the Air Force's KC-135 tanker aircraft, including various new engine configurations to replace the aircraft's aging J57-P-59W engines. In December 1977 the Air Force awarded a contract to The Boeing Company to prepare detailed technical and cost proposals for a KC-135 reengining program covering three different engines which had been identified in previous studies. In January 1980 the Air Force selected the CFM International CFM-56 engine from among the three competing engines for the reengining modification program. The CFM-56 was jointly developed by General Electric and Snecma of France and was certified by the Federal Aviation Administration in November 1979. Its first commercial application will be on a reengining program for the DC-8.

The reengining modification is a complex effort involving extensive development and testing that will reportedly provide several benefits. These include increasing the KC-135's survivability, safety, fuel efficiency, and fuel off-load capability. 1/ The reengined KC-135 will also be quieter and produce fewer pollutants. The primary reason for reengining the KC-135, however, is the need for additional aerial tanker off-load capability. A mission element need statement for the program has been submitted by the Air Force to OSD, but it has not yet been approved.

In late October 1980 the Air Force plans to award contracts totaling about $140 million for the initial effort to modify the first KC-135 aircraft with new engines and to complete the research and development work. The Air Force estimates that it would cost about $25 million (then-year dollars) to reengine each aircraft under the initial follow-on production program. The Air Force's objective has been to fund the program during fiscal years 1982-86.

MAJOR ISSUES

There are several issues concerning the KC-135 reengining program which should be addressed before additional funds are committed to the program. These include questions concerning the program's pace, cost effectiveness, need, and affordability.

Will the pace of the program correct existing problems?

Air Force plans, as of August 1980, were to initially reengine 131, or about 20 percent of its KC-135A/Q tanker fleet by fiscal year 1989. This would result in additional tanker off-load capability equal to the equivalent of about 65 additional unreengined KC-135As, or about a 10-percent increase in capability. If the program was to continue at this pace, it would be about the year 2000 before the total fleet of 642 could be reengined. The Air Force's plans were based on obtaining initial production funds for nine aircraft in fiscal year 1982, which we understand has been disapproved by OSD. Based on the relatively slow pace of the program, we seriously question whether it will correct existing problems with the aging J57-P-59W engine or increase tanker capability in a timely manner.

1/The amount of fuel which can be transferred to a receiver aircraft.

Has the most cost-effective solution to the problem been selected?

The original service life of the J57-P-59W engine was to have been 4,000 hours, but this has been exceeded, on the average, by over 2,500 hours. The J57-P-59W engine is becoming increasingly difficult and costly to maintain because of its prolonged operation and repeated repairs. The Strategic Air Command and AFLC believe it is vital that the J57, including the J57-P-59W, and the TF 33 engines on the C/KC-135 and B-52 aircraft fleets be rehabilitated to restore their durability and reliability and to prevent a reduction in mission capability. AFLC has established a program called Pacer Grade which would rehabilitate these engines through (1) improved rework and inspection procedures and (2) the time-phased replacement of hardware items that are experiencing frequent and extensive repairs.

AFLC estimates the total Pacer Grade program would cost about $2.6 billion (then-year dollars), which includes about $1.2 billion to rehabilitate all J57-P-59W engines on the entire KC-135 fleet. (As noted on p. 5, the cost to reengine the entire fleet could cost as much as $16 billion.) The Pacer Grade program is expected to increase the service life of the existing engines to about the year 2000 and increase their reliability; durability; and, to a very limited extent, fuel efficiency. Although the Air Force has not funded the program to date, AFLC plans, as of August 1980, would, if approved, result in funding the program over a 6-year period, with all J57-P-59W engines being rehabilitated by fiscal year 1989. Air Force officials said this program is required to keep the J57-P-59W engines in service in the near future and will be necessary regardless of the relatively long term reengining program. The reengining program is expected to reduce the number of J57-P-59W engines under Pacer Grade, but the actual reduction will depend on how rapidly the reengining program progresses. Although Pacer Grade will not increase tanker off-load capability, we believe it is a relatively low cost alternative that should be considered in reviewing the reengining program.

Have tanker requirements been properly assessed?

We believe the recently expressed congressional intent to deploy a replacement manned bomber for the B-52 by 1987 is a factor that should be considered in assessing tanker requirements in the mid to late 1980s. The Air Force has indicated that a primary factor in the need for additional tanker off-load capability is the fact that bombers now require more refueling support than in the past. This results from changes in mission profiles and tactics as well as range degradations caused by modifications, such as the increased drag caused by adding the Air Launched Cruise Missile. A more fuel efficient bomber could significantly affect tanker requirements and the potential need for the KC-135 reengining program as a means to increase tanker off-load capabilities.

The Air Force has prepared a tanker mix paper, dated August 1980, that discusses its tanker requirements as well as potential mixes of reengined KC-135s and new KC-10s that can meet these requirements. The Air Force is not clear as to what the ultimate use of the paper will be. We noted that it does not consider Pacer Grade or the issue of a new manned bomber. Also, it does not indicate how many KC-135s are planned to be reengined.

Is the program affordable?

Although the Air Force has not established firm quantities for the total program, the Strategic Air Command indicates a potential need to reengine the entire KC-135A/Q fleet of 642 tanker aircraft. In June 1980 Air Force Headquarters officials said that a minimum of 300 aircraft would need to be reengined. Based on a unit cost of about $25 million per aircraft, it could cost approximately $16 billion to reengine 642 aircraft and approximately $7.5 billion to reengine 300. Program office officials believe the $25.0 million unit cost could be reduced to as low as $17.5 million per aircraft if an optimum modification rate of six aircraft per month were approved. Based on a unit cost of $17.5 million, it would cost about $11.2 billion to reengine 642 aircraft, while the cost for 300 aircraft would be about $5.2 billion. In view of other long range, high cost programs currently in process, there is a question as to the affordability of the program.

CONCLUSIONS AND RECOMMENDATIONS

As noted in several of our previous reports, we strongly support the DSARC process for analyzing a system's need, cost effectiveness, risk areas, affordability, and other factors at key decision points during the acquisition process. We believe that because of the questions raised in this report, a DSARC review of the KC-135 reengining program should be conducted. Such a review is particularly critical at this time because of the Air Force's plans to award contracts in late October 1980 totaling about $140 million for the initial effort to modify the first KC-135 aircraft and to complete research and development. Further, while a mission element needs statement has been prepared for the program, it has not yet been approved by OSD.

To avoid the possibility of continuing to develop a system which may not be needed, affordable, or the most cost-effective alternative, we recommend that you direct DSARC to review this program to answer these basic questions concerning the program. Other issues may also come to light which warrant DSARC consideration. We further recommend that you direct the Air Force to withhold its planned October 1980 contract awards until DSARC has completed its review.

U.S. PARTICIPATION IN THE UNITED KINGDOM'S DEVELOPMENT OF JP-233--A COSTLY DEVIATION FROM ACQUISITION POLICY

We have reviewed the JP-233 Low-Altitude Airfield Attack System as part of our annual review of selected major weapon systems. Our objective was to examine U.S. participation in this United Kingdom development effort including how well the Department of Defense (DOD) had defined its requirements and assessed alternative solutions. We obtained information from records and officials at the joint program office in London comprised of staff representing United Kingdom and U.S. personnel, at Air Force Headquarters and the Office of the Secretary of Defense, the Air Force Tactical Air Command (TAC), and the Armament Division of Air Force Systems Command. We did not evaluate United Kingdom program management or mission requirements.

At various times during our review, we briefed the staffs of the House and Senate Appropriations and Armed Services Committees. In December 1980, near the completion of our review, the Congress denied the $56.5 million the Air Force had requested for fiscal year 1981. Although the United States is no longer a participant, we want to bring several issues to your attention that deal with the overall acquisition strategy followed on this foreign developed system. We believe lessons learned should have application to future acquisitions of this kind.

DOD participation in the JP-233 development did not follow prescribed acquisition strategy which requires initial project definition and continued formal oversight at key decision points. As a result, the Air Force committed more and more resources without fully defining mission needs or formally evaluating alternative solutions. At the time of congressional action in December 1980, the Air Force had spent about $109 million and is now negotiating termination costs that may exceed $25 million.

SYSTEM DESCRIPTION AND HISTORY

JP-233 was intended to reduce the sortie generation capability of Warsaw Pact Air Forces by damaging runways and other operating surfaces and impeding efforts to repair them. The United Kingdom began feasibility studies in 1971 and moved into the project definition phase in April 1975. The U.S. participation began in August 1976 under the foreign weapons evaluation program. Joint definition efforts continued until June 30, 1977, when the joint validation phase began.

The United Kingdom wanted to begin full-scale development in November 1977; however, U.S. Air Force representatives in the joint program office believed some additional project definition work was necessary. As a compromise, and to keep the program going, the United States agreed to a "qualified" full-scale development phase that lasted until January 1, 1979, when the Air Force formally committed the United States to funding half the joint program through the end of development. This move seemed to be premature based on information available at the time.

INCOMPLETE MISSION ANALYSIS

Though DOD did not prepare a mission area analysis before joining the JP-233 effort, two technical reports on airfield attack, based on work done by the Air Force Armament Division at Eglin Air Force Base, Florida, were available at the time. Because of high aircraft attrition rates, these reports recommended airfield attack weapons that permit delivery aircraft to standoff and not fly directly over enemy airfields.

TAC also analyzed the airfield attack mission area, but its draft analysis did not appear until June 1979, more than 1-1/2 years after the Air Force began qualified full-scale development with the United Kingdom, and 5 months after the United States was committed by the Air Force to paying half of the joint development cost. As of February 2, 1981, TAC had not completed the analysis and was unable to estimate when it would be completed.

Various other studies dealing with airfield attack and airfield attack weapons have appeared since the United States joined the JP-233 development effort. These studies were not conclusive because DOD had not sufficiently defined the mission and because the studies did not always agree on matters such as attrition, system capabilities, and costs. But, the studies did establish that several airfield attack systems in production or various stages of development offer alternatives. The studies also indicated that limited U.S. aircraft allocations for airfield attack and high expected attrition seriously limit the effectiveness of aircraft-delivered weapons, particularly those without standoff capability.

CONTINUED FUNDING DESPITE COST AND TECHNICAL UNCERTAINTIES

There were also cost and technical indicators that the Air Force decision to commit to JP-233 was premature. For example, Air Force budget estimates were not refined to adequately project development and procurement costs. U.S. budget requests increased 155 percent from fiscal years 1978 through 1981 for development costs alone, primarily because of inadequate provisions for United Kingdom inflation and fluctuations in the dollar/pound exchange rate. These same factors caused estimated U.S. procurement costs during this period to increase from $522 million to almost $3 billion. Without including inflation and exchange rate fluctuations, the United Kingdom contractor's development cost estimate increased almost 22 percent from January 1979 to July 1980.

As for technical status, during our visit to the London program office in October 1980, we found that all components of the system had uncertainties that would have to be resolved before total performance could be demonstrated. While most components appeared to be within the state of the art, technology supporting the cratering submunition had yet to be validated through actual low-level aircraft delivery. Air trials to demonstrate live emplacement of a single cratering submunition were not scheduled until June 1981--about 3-1/2 years after the start of full-scale development.

USUAL HIGH-LEVEL REVIEW NOT PROVIDED

In addition to the above factors, the JP-233 system was not designated as a major acquisition. Instructions from the Office of Management and Budget and DOD suggest that such systems be designated major based on (1) the criticalness of the mission, (2) the amount of resources required, and (3) the need for special management attention. The purpose of such a designation is to better assure that a system meeting these criteria will get the high-level management attention it deserves. We believe JP-233 met most, if not all, of the suggested criteria. For example, even at the outset, U.S. costs of $85.8 million for development and $533 million for production exceeded the suggested $75 million and $300 million cost criteria. We also believe that as an international project requiring formal commitments to another country that could not be unilaterally withdrawn without some difficulty, JP-233 appeared to deserve special management attention.

By not being designated as a major system, JP-233 was not given the usual high-level review, coordination, and visibility at key decision points. For example, JP-233 transitioned from project definition through validation and into full-scale development, and could have gone into production without formal justification before the Defense Systems Acquisition Review Council (DSARC). A principal function of a formal DSARC review is to question proposed commitments at key points in the development period. The DSARC reviews would have raised questions about a system which did not have a completed mission analysis, requirements documents, and evidence that alternatives had been considered and that technology supporting the chosen alternative had been validated through realistic demonstrations. Also, periodic reporting requirements for major systems would have increased JP-233's visibility and coordination within the Congress.

CONCLUSIONS AND RECOMMENDATIONS

DOD acquisition policies require thorough analyses of missions, needs, costs, and alternatives before committing substantial resources. Further, such a commitment requires formal, high-level, and ongoing reviews that consider new information and changing circumstances at key decision points to assure the reasonableness of continuing a program. The Air Force did not follow this approach in committing the United States to the JP-233 program. We believe initial project definition and continued oversight are crucially important, particularly for acquisitions requiring international commitments, to reduce the risk of abrupt U.S. terminations and the strained international relationships that could result.

DOD committed the United States to paying half the development cost of JP-233 without formal analyses of mission requirements, current capabilities, needs, and alternative solutions. Therefore, the United States was formally committed to developing a weapon with an ally without assurance that it would either accomplish the U.S. mission or that it was the best alternative. Furthermore, even though it met several of the specific criteria, DOD did not designate the system as "major," and thus eliminated the usual formal, high-level review at key decision points in the acquisition cycle.

From August 1976 to the official U.S. notice of intent to terminate in December 1980, the Air Force spent almost $109 million, including $12.1 million as the U.S. share of costs the United Kingdom incurred before the United States joined the development. In addition, U.S. termination costs now being negotiated may exceed $25 million.

We have no specific recommendations to make on the JP-233 because it has been terminated. However, there are some lessons to be learned from the way the program was managed which may have application to future acquisitions. Therefore, we recommend that you should:

--Assure that mission requirements, capabilities, and needs are well defined before committing significant resources for either U.S. or allied weapons development or procurement. Such assurance is particularly critical before making international commitments from which the United States cannot unilaterally withdraw without some difficulty.

--Direct the Secretary of the Air Force to specifically define the requirements for the airfield attack mission to provide a basis for identifying and comparing alternative weapons and delivery modes. These comparisons should specifically take into account (1) delivery aircraft sortie availability and attrition for weapons that require deep penetration of enemy territory and (2) the cost and benefits of using pretargeted, surface-to-surface missiles, and other standoff weapons.

--Require high-level reviews for any costly weapon. These reviews should assure that the chosen system (1) has demonstrated performance through realistic operational tests, (2) is the best alternative among the candidates, and (3) is capable of performing its mission, either alone or in concert with other planned systems.

--Limit funding requests for airfield attack weapons to only those levels needed to validate the various technologies as a basis for system comparisons and that the restriction apply until the Secretary of the Air Force completes the mission analysis and you certify the mission contribution of proposed weapon solutions.

COMMENTS BY DOD PROGRAM OFFICIALS AND THE UNITED KINGDOM

We did not request official DOD comments on this report. Instead, a draft of this report was discussed with high-level DOD officials associated with management of the program to assure that the report is accurate and complete. They had no specific disagreement with our conclusions and recommendations.

Written comments were provided by the United Kingdom and are enclosed at their request. The United Kingdom expressed concern that this report does not address our broader original objective of assessing cost, schedule, technical status, and logistics. While our original plan was to report on these broader areas, our report was reprogramed when the Congress terminated U.S. funding. The United Kingdom also expressed concern that our report implied that they rushed the Air Force to collaboration. This implication was not intended. The report cites the events that took place during the 3-year period preceding the formal U.S. commitment in January 1979. The United Kingdom further said that the Air Force does not consider the competing systems as viable alternatives to JP-233. The Air Force is still testing and evaluating the alternative systems and has not made a decision on their viability. The United Kingdom agreed that most of the cost increase in Air Force budget estimates were caused by inadequate allowance for inflation in exchange rate fluctuation. We also clarified that the 22-percent increase was for development rather than procurement cost. The United Kingdom also expressed concern that our report implied that high-level U.S. officials did not devote management attention to that project. They specifically pointed out certain briefing of top-level officials. Our concern is still that this was a system requiring rigorous formal review processes because of its costs and sensitivity but which did not receive these reviews.

Contents

CHAPTER		Page	
1	SYNOPSIS	1	1/A9
	System effectiveness issues	3	1/A12
	Program acquisition issues	7	1/B2
	Potential impact of our recommendations	12	1/B7
2	ARMY PROGRAMS	15	1/B11
	Potential of LoAD Ballistic Missile Defense System for protecting the MX system	16	1/B12
	Issues concerning development of ballistic missile defense systems	21	1/C3
	Problems affecting the procurement and operation of the Army's AH-64 attack helicopter and associated systems	24	1/C6
	The Army's Standoff Target Acquisition System--a program having development difficulties	28	1/C10
	Future procurements of the Army's Copperhead projectile should be contingent on improvements in performance and reliability	31	1/C13
3	NAVY PROGRAMS	35	1/D3
	The Navy's lightweight torpedo: a new weapon that faces many development challenges	36	1/D4
	The Light Airborne Multi-Purpose System, LAMPS MK III, progress evident but some problems and questions remain	39	1/D7
	Opportunities for improving management of the Navy's Aegis Cruiser	43	1/D11
	Issues affecting the Navy's Anti-Ship Cruise Missiles	47	1/E1
	F/A-18 Naval Strike Fighter: progress has been made but problems and concerns continue	51	1/E5
4	AIR FORCE PROGRAMS	55	1/E9
	The MX Weapon System: issues and challenges	56	1/E10

Page

CHAPTER

4 DOD participation in the Space Transportation System: status and issues 59 1/E13
The F-16 Program: progress, concerns, and uncertainties 63 1/F3
The Department of Defense should resolve certain issues concerning the C-X aircraft before requesting proposals from industry for its full-scale engineering development 67 1/F7
Major issues concerning the C-X range and payload remain unresolved 72 1/F12
The Department of Defense should resolve major issues regarding reengining the KC-135 aircraft before continuing the program 78 1/G4
U.S. participation in the United Kingdom's development of JP-233--a costly deviation from acquisition policy 83 1/G9

5 JOINT PROGRAMS 89 2/A3
Some Land Attack Cruise Missiles Acquisition Programs need to be slowed down 90 2/A4
Review of the High Speed Anti-Radiation Missile Program 95 2/A9
Progress and problems of the Advanced Medium Range Air-to-Air Missile Program 99 2/A13
Decisions to be made in charting DOD's Assault Breaker 104 2/B4
Most critical testing still lies ahead for missiles in Theater Nuclear Modernization Program 109 2/B9
Review of Air Force's Next Generation Trainer Aircraft Program 116 2/C2
Air Force and Navy plans to acquire trainer aircraft 119 2/C5

APPENDIX

I Listing of other related reports issued from March 7, 1980, through March 31, 1981 125 2/C11

CHAPTER 5

JOINT PROGRAMS

SOME LAND ATTACK CRUISE MISSILES ACQUISTION PROGRAMS NEED TO BE SLOWED DOWN

Cruise missiles are subsonic, jet-powered airframes that are being acquired to deliver nuclear or conventional warheads against a variety of targets. During the last 8 years or so, development efforts have been focused on versions that are about 20 feet in length which can be built by exploiting advances in propulsion and guidance technology. This report discusses major areas of concern with regard to matters which affect the acquisition and deployment of these missiles.

The Department of Defense (DOD) is pursuing four major land attack cruise missile acquisition programs which, in the aggregate, can represent an investment cost in excess of $10 billion:

Program	Quantity	Status	Application
Air-Launched Cruise Missile	3,418	Production	Strategic/ nuclear
Sea-Launched Cruise Missile (Tomahawk)	To be determined	Limited production	Tactical/ nuclear and nonnuclear
Ground-Launched Cruise Missile	560	Full-scale development	Tactical/ nuclear
Medium Range Air-to-Surface Missile	a/3,500	Full-scale development	Tactical/ nonnuclear

a/As this report was being prepared for publication, the Navy announced that it was withdrawing from the Medium Range Air-to-Surface Missile Program. As a result this number will decrease.

If these new cruise missiles can adequately survive enemy defenses and deliver their warheads with projected accuracy, military analysts believe they can be more cost effective than manned aircraft in attacking some heavily defended strategic and tactical targets.

STRATEGIC APPLICATIONS--AIR-LAUNCHED CRUISE MISSILE

The Office of the Secretary of Defense has placed the highest national priority on deployment of the Air-Launched Cruise Missile system in order to preclude shortfalls in strategic weapons in the 1980s. Accordingly, a rigorous, success-oriented, highly concurrent schedule was established. Production of the missile was authorized in April 1980, even though a number of critical problems remained to be resolved. Specifically:

--Operational testing completed before the production decision revealed that mission reliability of the system was deficient and failed to demonstrate important missile performance features, such as accuracy and terrain-following capability.

--The testing that had been done was not operationally realistic.

--Engine reliability was still a matter of serious concern.

--Certain components which were essential to the system's performance have not been available for operational testing.

--A critical measurement program was about a year behind schedule.

--Errors in the terrain elevation data base may be a problem.

The Air Force has initiated a follow-on phase of operational testing, and other measures that address these problems are underway. For the most part, however, these efforts will not be concluded by September 1981 when the first carrier aircraft is scheduled to achieve alert status with 12 missiles.

In striving to meet the highest national defense priority for early deployment of the Air-Launched Cruise Missile/B-52 weapon system, DOD established a highly concurrent program. Despite the problems discussed above, DOD approved the missile for production to maintain prospects for early deployment. This decision may have been prudent and expedient, but if the problems are not resolved quickly, the system may be deployed with severe operational limitations and little may be gained.

TACTICAL APPLICATIONS

The Navy plans to request authority to begin full-scale production of the first tactical land attack cruise missile system in December 1981. Major problems that should, but probably cannot, be satisfactorily resolved before that time are as follows:

--Cruise missiles, as presently designed, probably will not be sufficiently accurate to deliver conventional warheads effectively against some targets, and scheduled testing will probably not resolve the matter.

--Because of exposure to enemy defensive systems, under some circumstances, there is considerable doubt about how survivable these missiles will be when delivering certain non-nuclear warheads.

--No statement of mission need has been prepared to support acquisition of the Tomahawk or Medium Range Air-to-Surface Missiles. In addition, establishing realistic inventory objectives will be complicated by uncertainties about duplication of capability, accuracy, and survivability.)

In the past, maintaining the Tomahawk airframe contractor's continued commitment has been a matter of considerable concern in DOD. However, it should be possible to maintain that commitment at an appropriate level without initiating full-scale production in December 1981.

The present considerable uncertainty about accuracy and survivability of conventional land attack cruise missiles is not likely to be resolved by December 1981. Because of this, GAO believes that DOD should immediately begin to define an alternative to full-scale production of the conventional Tomahawk missile which allows time for the additional test and development efforts that may be required to convincingly demonstrate cruise missiles can deliver conventional warheads with effective accuracy and without being unreasonably vulnerable to enemy defensive systems.

No definitive mission need supports the acquisition of land attack Tomahawk or Medium Range Air-to-Surface Missiles, and because the missiles' accuracy and survivability has not been established, there may be better alternatives to using cruise missiles to attack land targets with conventional warheads.

RECOMMENDATIONS

With regard to assuring that the Air-Launched Cruise Missile and tactical land attack cruise missiles with conventional warheads will be operationally effective, GAO recommends that the Secretary of Defense

--closely monitor the Air-Launched Cruise Missile program to ensure the resolution of operational testing issues, engine reliability problems, uncertainty about terrain roughness thresholds, and deficiencies in the terrain elevation data base prior to deployment and

--withhold authorization to proceed with full-scale production of any land attack missile with a conventional warhead until the accuracy and survivability of such a system is convincingly demonstrated in realistic operational testing.

Because a definitive statement of mission needs is required, GAO recommends that the Congress not appropriate additional funds for procurement of either land attack Tomahawk or the Medium Range Air-to-Surface Missiles until the Secretary of Defense comprehensively defines and reconciles overall DOD requirements to attack land targets from standoff ranges characteristic of tactical cruise missiles.

AGENCY COMMENTS

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

REVIEW OF THE HIGH SPEED ANTI-RADIATION MISSILE PROGRAM

The High Speed Anti-Radiation Missile (HARM) is being developed to give aircraft performing surface attack missions a better chance of penetrating enemy radar defenses by destroying or suppressing radars which direct enemy surface-to-air missiles and antiaircraft guns. The system is designed to detect, identify, and lock on to a wide range of enemy radars and then launch the HARM missile to home on and destroy the target.

GAO reviewed the HARM program to determine whether it had met the development objectives that were required to be met before awarding a limited production contract for 80 missiles. GAO believes the HARM system has demonstrated the performance that was required before limited production.

Full-scale production of HARM is scheduled to begin in 1982, following completion of operational testing.

Major problems that halted flight testing in October 1979 appear to have acceptable solutions. (See p. 6.) Other problems and concerns remain. Solutions acceptable to the Navy and Air Force, although not necessarily complete solutions, appear available for remaining problems noted to date. Some remaining problems are described below.

--A great deal of labor and time on test facilities is required to compensate (or adjust) each HARM seeker and perform acceptance testing. This is expensive and reduces the life of the seeker. Unless the time required to compensate and test seekers is substantially reduced from the current 400 hours, as the contractor and the Navy expect, additional test facilities may be needed to meet the full-scale production rate. Alternatively, HARM production might have to be stretched out to accommodate the number of test facilities available.

--In one of the Navy's operational modes for using HARM, missiles may be launched at targets that are falsely displayed to the pilot. Such targets cannot be hit. A solution to this problem exists; however, its implementation would be expensive and would involve a new piece of equipment.

--Wing flutter has been noted on some firings and captive flights. A serious flutter could affect a missile's accuracy.

--The Air Force HARM system is limited in its effectiveness by a basic design limitation in another part of the aircraft weapons system that will use HARM.

--The Air Force and Navy operational testers are concerned with the adequacy of HARM's built-in test capability.

--In the Navy HARM system, common threat information is not programed into both the radar warning receiver and the command launch computer. The Navy has instructed the contractor to prepare the necessary software change to correct this problem.

--The Air Force does not believe that the so-called multipath phenomenon 1/ is adequately understood and that corrective actions to mitigate its effects on HARM are sufficient.

1/A condition where radar signals are received indirectly after having bounced off buildings or terrain features as well as directly from the radar.

--Another problem, the description of which is classified, is discussed on pages 10 and 11.

In addition to the above problems, there are concerns and uncertainties in other areas, as follows:

--Although development and production concurrency is less now than it was before flight testing was halted in October 1979, some concurrency remains. There is, therefore, a degree of risk in going into limited production before operational testing. Solutions to currently known problems appear to be acceptable, but they may not prove to be adequate.

--Two of the 11 missile firings since March 1980 were failures. One other firing had to be aborted because of technical difficulties. Both failures and the aborted firing were attributed to poor quality control in producing the missile control sections. Although the contractor has taken measures to improve quality control, the Naval Weapons Center is still concerned.

--Three other firings in 1980 were considered by the Navy as partial failures because of target miss distances.

--The HARM program will be committed to limited production before a high degree of reliability has been demonstrated. If reliability does not improve as fast as expected, a low degree of reliability might be present in the 80 limited production missiles which will be used to establish the Navy's initial operational capability.

--The HARM seeker was tested in a special ground facility to determine the missile's ability to withstand various electronic countermeasures. The results of these tests are discussed on pages 17 to 20.

--A decision to change the HARM specification to hold down cost has reduced HARM's ability to cope with certain radars.

RECOMMENDATION

GAO recommends that before the HARM system is permitted to enter full-scale production, the Secretary of Defense provide assurances to the Congress (1) that key identified technical problems have been solved and their solutions proven by testing and (2) that HARM has the potential for meeting anticipated future threats despite the specification change which reduced HARM's capability against certain radars.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete.

PROGRESS AND PROBLEMS OF THE ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE PROGRAM

The Advanced Medium Range Air-to-Air Missile (AMRAAM) is being developed as an all-weather, air-to-air missile responding to Air Force and Navy operational requirements for the 1985-2005 time frame. Operating both within and beyond visual range, AMRAAM is to be compatible with the F-14, F-15, F-16, F-18, and other appropriate aircraft. It is intended to replace the aging Sparrow medium range air-to-air missile.

AMRAAM is currently in a 33-month concept validation phase scheduled to be completed in November 1981. The full-scale engineering development phase is scheduled to end in March 1985, and delivery of first production items is to follow in September 1985. As of January 1979, the Air Force estimated that AMRAAM's life-cycle cost for 20,000 missiles would be $3.9 billion.

GAO was severely hampered on this review because the Air Force withheld most of the current cost, schedule, and performance data on the basis of the data being competition sensitive. GAO could not therefore fully assess the program's status and is issuing this interim report on the basis of the limited data made available. The Secretary of the Air Force released the data in late November 1980, too late for GAO's analysis and inclusion in this interim report. GAO plans to issue a more comprehensive report based on its follow-on review of the recently released program data.

GAO's review of the limited data released identified the following problems related to the AMRAAM program:

--The Air Force and Navy may be unable to fully test AMRAAM during full-scale engineering development because of deficiencies in high altitude, high speed targets.

--Operational questions exist regarding the full use of AMRAAM in a beyond visual range role.

--The total costs related to AMRAAM have not been estimated, but available information shows that total costs will be much more than the $3.9 billion life-cycle cost forecasted in January 1979.

TESTING CONCERNS

High altitude, high speed targets projected to be available during AMRAAM's full-scale engineering development testing will not fully satisfy certain AMRAAM test requirements. The targets will not have the capability to either fully simulate the threat or provide scoring data to assess system lethality. Unless more capable targets are made available to fully test AMRAAM's capabilities, the system could be approved for production with unknown performance deficiencies or the production decision could be delayed because of insufficient performance data.

The Department of Defense has known for several years that more capable high altitude, high speed targets are needed for testing such high performance missile systems as AMRAAM, but a program to develop a more capable target has been given low priority. The services established a high altitude, high speed target development program in 1970, but current projections indicate the target will not be available until January 1985, about 2 months before completion of AMRAMM's full-scale engineering development phase. If the targets were available for testing AMRAAM, as currently designed, it would still not fully satisfy AMRAAM test requirements.

Air Force Headquarters officials told GAO that existing targets in inventory will be set aside for testing AMRAAM and that they believed those targets will be adequate. The officials could not, however, provide supporting data showing that these targets, with their known limitations, will satisfy AMRAAM's high altitude, high speed testing requirements.

AMRAAM program officials told GAO that any AMRAAM performance deficiencies would be disclosed by simulations and flight test demonstrations at lower altitudes. However, the May 1977 requirement document for the high altitude, high speed target development program stated that lack of a high altitude, high speed target increases the probability of air superiority weapon systems having unrecognized performance deficiencies until used in an air combat environment.

OPERATIONAL QUESTIONS

The United States and its North Atlantic Treaty Organization (NATO) allies may be unable to fully utilize AMRAAM's beyond visual range capability. AMRAAM's full use in a beyond visual range role will require that the United States and its allies have the capability to positively identify potential targets as friend or foe. However, the principal identification, friend, or foe (IFF) system currently used, the 1950-vintage Mark XII, has operational inadequacies.

In an effort to resolve the IFF problem, the Department of Defense has initiated action to develop an improved NATO-interoperable IFF system under a cooperative development program. At the time of our review, however, there was uncertainty as to when such an improved NATO-interoperable IFF system could be deployed.

Until new equipment is deployed, the rules-of-engagement for employing beyond visual range weapon systems need to be optimized.

ESTIMATED COSTS

Total costs related to AMRAAM have not been estimated and all current cost information was not provided to GAO, but data provided showed that total costs associated with AMRAAM will be much more than the January 1979 life-cycle cost estimate of $3.9 billion. The AMRAAM costs will be much higher because

--estimated development costs had already increased $179 million, or 45 percent, between January 1979 and April 1980, and the April 1980 estimate of $575 million did not include all costs related to AMRAAM development (see pp. 13 and 14) and

--the January 1979 estimate did not include tactical aircraft modification costs which could amount to $900 million for F-15 and F-16 aircraft and an undetermined amount for F-14 and F-18 aircraft.

In addition to these costs, the Office of the Secretary of Defense has directed the Air Force to conduct a costly operational utility evaluation of AMRAAM. Air Force officials said that preliminary estimates indicate the evaluation could cost $200 million.

GAO had insufficient data to project the total estimated costs related to AMRAAM. The Air Force was withholding data on updated life-cycle cost estimates for AMRAAM, and the Navy had not estimated total costs to modify F-14 and F-18 aircraft for AMRAAM.

RECOMMENDATIONS

GAO recommends that the Secretary of Defense •

--reconsider the need for high altitude, high speed target subsystems, such as improved radar and infrared augmentation, cooperative vector scoring, and threat representative countermeasures, in order to adequately test the operational capabilities of AMRAAM;

- --aline the development schedule for the high altitude, high speed target with AMRAAM's full-scale engineering development schedule;

- --urge the adoption of rules-of-engagement, pending improved IFF capability, which permit optimum employment of such air superiority systems as AMRAAM; and

- --provide the Congress with the total estimated cost of development, procurement, and deployment of AMRAAM, including the associated aircraft modification costs.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included where they differ with GAO's.

DECISIONS TO BE MADE IN CHARTING DOD'S

ASSAULT BREAKER

Assault Breaker is a Department of Defense (DOD) concept using standoff weapons to attack moving, rear echelon armor massed deep behind enemy lines. Presently, the only nonnuclear means for attacking these targets is by the use of manned, penetrating aircraft. The advantage of Assault Breaker is that it would permit attacking these targets with standoff weapons. The concept involves using an airborne radar; airborne or surface launchers; strike missiles with submunition dispensers; antiarmor self-guided submunitions that are dispensed over the target; and a communications, command, and control network.

Assault Breaker was conceived to obtain a uniquely high rate of kill at a much smaller risk and cost than present weapons permit. DOD officials believe Assault Breaker's fire rate could destroy in a few hours sufficient vehicles in Warsaw Pact reinforcement divisions to prevent their exploiting a breakthrough of North Atlantic Treaty Organization (NATO) defenses. Preliminary estimates of acquisition costs are about $5.3 billion.

Two modes of delivering Assault Breaker munitions are being considered. The Army has proposed a ground-launched missile and the Air Force proposes that the missile be air-launched. The Army's proposal contemplates fielding Assault Breaker as an addition to its planned Corps Support Weapon System. This system is to replace the existing nuclear LANCE system. The Army is considering using the Air Force's PAVE MOVER targeting radar for its Corps Support Weapon System. The Air Force proposes launching the Assault Breaker weapon from one of several aircraft candidates, including the B-52, and is considering using one of the Army missiles that would evolve from the Assault Breaker development effort.

The schedule for completing development of an Assault Breaker capability is uncertain. DOD is considering delaying the start of engineering development until 1983, or later, to provide more time for proving the concept's feasibility.

Assault Breaker's development began with a concurrent concept definition and advanced development phase looking towards an early deployment of the system. This tight schedule allows for only limited testing of several important program elements, involving medium to high risk, before a decision on full-scale engineering development is made.

DOD faces major decisions before committing large resources to Assault Breaker development. It must decide

--whether the testing planned in advanced development is sufficient to demonstrate the feasibility of the Assault Breaker concept before full-scale engineering development is to begin

--how Assault Breaker compares in cost effectiveness to other weapons that could attack rear echelon armor

--how Assault Breaker's development should be managed.

Other systems like the Army's Corps Support Weapon System and Multiple Launch Rocket System using a terminally guided warhead, and the Air Force WASP minimissile, are to be used to attack rear echelon reinforcements and are scheduled for fielding about the same time.

Analysis is needed to put in perspective the relative contributions to be anticipated from these systems in combat. This will require developing reliable cost and effectiveness data for purposes of comparison. Such data is not yet available. The choices may be influenced by such considerations as changes that may be needed in service force structures, the increased survivability promised by the new technology that permits delivering munitions from standoff distances, the respective battle roles of the Army and Air Force, and funding constraints that are affecting the development and procurement of new weapons.

Assault Breaker poses an unusual management challenge because

--it could involve changes in how to do the interdiction mission;

--it includes a proposal for a cooperative weapon system, where the Air Force owns the target acquisition system and the Army owns the strike weapon;

--it requires coordinating the Office of the Secretary of Defense, Army, and Air Force concepts on how the system should be developed and fielded; and

--the Office of the Secretary of Defense, which initiated the concept, lacks the resources to manage the acquisition of assets to implement this cross-service concept.

CONCLUSIONS

It is too early to assess whether Assault Breaker will fulfill its technical promise. The program includes new technologies involving medium-to-high risks. Proposals being considered which would postpone the start of Assault Breaker's engineering development by about 2 years provide an opportunity for more extensive testing in high risk areas before a full-scale development decision has to be made.

There are important reasons for closely monitoring and coordinating Assault Breaker's development. The subsystems involved are approaching the point where, if they are approved for engineering development, larger commitments of funds will be required. Assault Breaker, as presently conceived, may incorporate assets of both the Army and the Air Force and should, therefore, involve the two services in the integrated testing of the subsystems. Funding the continuing development of the subsystems that make up Assault Breaker, making it available for integrated testing, and evaluating the competing Assault Breaker concepts, argue for establishing a more permanent organizational structure, with representation from the Office of the Secretary of Defense and the two services, to assume responsibility for the program's direction. DOD officials contend such action would be premature, considering Assault Breaker's current early stage of development. GAO believes the present arrangement of having a small group in the Office of the Secretary of Defense, supplemented by ad hoc committees to oversee a program of this magnitude, is insufficient.

RECOMMENDATIONS TO THE SECRETARY OF DEFENSE

GAO recommends that the Secretary of Defense improve the basis for investment decisions on Assault Breaker and competing programs by

--reviewing plans for the advanced development testing of Assault Breaker to assure that they will be sufficient to demonstrate the feasibility of the Assault Breaker concept before a decision is made on beginning full-scale engineering development;

--coordinating several DOD cost and effectiveness analyses of antiarmor weapons for attacking rear echelons to require similar scope, assumptions, and methodology to the extent practicable so that their relative contributions to combat effectiveness and their cost can be compared and conclusions drawn for the best combinations of weapons to procure; and

--establishing an office to centrally manage the development of the Assault Breaker.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is accurate and complete. Their points of view are included.

MOST CRITICAL TESTING STILL LIES AHEAD FOR MISSILES IN THEATER NUCLEAR MODERNIZATION PROGRAM [1]

The Department of Defense is developing two missiles, the Army's Pershing II and the Air Force's Ground Launched Cruise Missile, as part of a program to modernize its theater nuclear forces in Europe. The two weapons are to provide the North Atlantic Treaty Organization (NATO) with a capability to launch land-based theater nuclear missiles from Western Europe that can strike targets within the Soviet Union. Deployed theater nuclear missiles cannot reach beyond the Soviet satellite countries of the Warsaw Pact.

RATIONALE FOR MODERNIZING THEATER NUCLEAR FORCES

Modernizing theater nuclear weapons was spurred, not only by the Soviet deployment of the Backfire bomber and the SS-20 ballistic missile, but also by the emergence of Soviet parity with the United States in strategic nuclear systems. This has increased NATO's concern that the Soviet Union could mistakenly come to believe it could use its long-range theater nuclear weapons to strike NATO targets without drawing a strategic retaliatory response from the West. The modernizing of theater nuclear forces is intended to provide NATO with a more flexible response to any Soviet initiative in that it will add a credible theater nuclear capability to NATO's other options.

In a December 1979 meeting, NATO ministers decided that the Ground-Launched Cruise Missiles would be deployed on the territories of the Federal Republic of Germany, the United Kingdom, Italy, Belgium, and the Netherlands, and that the Pershing IIs would replace the

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[1] A classified version of this report was published on January 30, 1981 (C-PSAD-81-6).

Pershing Ia's in the Federal Republic of Germany.

POLITICAL ASPECTS OF DEPLOYMENT

The participating NATO ministers unanimously agreed to continue arms control efforts simultaneously with the planned modernizing and deployment of the theater nuclear weapons, with the belief that combining the two would best meet NATO's security needs. Accordingly, the December 1979 decision explicitly provided for a parallel approach linking both efforts, modernizing, and arms control. Preliminary exchanges on arms control between the United States and the Soviet Union were held from October 17, to November 17, 1980, in Geneva. These provided an opportunity for both sides to clarify their positions and better define the scope of future negotiations. The exchanges are to resume in 1981.

The United Kingdom, the Federal Republic of Germany, and Italy are implementing the plan. Belgium and the Netherlands initially expressed reservations about deployment in their own countries. A Belgian cabinet decision of September 19, 1980, indicates that the Belgian Government would agree to participate proportionately in the eventual NATO deployment. The final total of missiles to be deployed may be affected by progress made in the arms control talks. GAO, however, has not independently confirmed Belgium's position. The Netherlands plans to wait until late 1981 before making a commitment on deployment.

MODERNIZING OBJECTIVES

The new weapons are not only to provide increased range over the current land-based theater nuclear missiles, but are also expected to be more accurate and more survivable. Both Pershing II and the Ground Launched Cruise Missile are to be armed with warheads that would inflict only minimal collateral damage around the target area. Testing to date has been too limited to provide an absolute indication that either missile will achieve all these objectives.

RESULTS OF PERSHING II'S INITIAL TESTS

Tests to demonstrate Pershing II's range will not begin until April 1982 when the Army plans to conduct the first of 28 scheduled missile firings. The Army is satisfied that several critical test objectives were met in five firings during advanced development, although only one achieved the desired accuracy. Nevertheless, this one successful firing is encouraging because it demonstrated the feasibility of achieving the specified accuracy. Pershing II's new guidance concept, however, which employs a new terminally guided reentry vehicle and is the heart of the system, has yet to be observed in the critical operational testing of the full system.

CONCURRENCY IN PERSHING II PROGRAM

After the start of the program, a Secretary of Defense decision advanced Pershing II's originally planned deployment date by 16 months--recently adjusted to 12 months. This decision was made in anticipation of the NATO ministers' agreement, and to bring Pershing II's deployment more in line with that of the Ground Launched Cruise Missile. Consequently, the Pershing II program now has a high degree of concurrency; that is, its development will continue well after the initial production decision is made. Normally, production contracts are awarded shortly after a favorable production decision. The Pershing II production decision is due after only the first two missiles have been test fired, and long before engineering development has been completed. The Army believes that technical problems which remain are not high risk and is confident that Pershing II can adhere to its schedule.

CRUISE MISSILE TESTING AND SCHEDULE CONCERNS

The Ground Launched Cruise Missile has considerable similarity with two other cruise missiles in development, one air launched and one sea launched. Therefore, the Air Force will evaluate the Ground Launched Cruise Missile's progress not only on the basis of its own showing in testing, but also on the basis of the test results of the other two missiles.

To date, there have been no Government flight tests of the Ground Launched Cruise Missile. Operational tests of the air launched missile, still in progress, have revealed some serious problems relating to its (1) ability to maintain flight levels that would minimize radar detection, (2) terrain contour mapping guidance, and (3) reliability. The same problems are presumed to apply to the other two missiles.

There has been a recent substantial slip in the Ground Launched Cruise Missile test schedule due to problems with developing the software. Although the start of operational testing and the scheduled production decision have both slipped, the initial operational capability date remains firm. With this change, the time available from the start of the missile's production until its scheduled initial deployment has been cut in half.

Regardless of these slippages and other uncertainties remaining in the development of both Pershing II and the Ground Launched Cruise Missile, the Departments of State and Defense have reiterated that the United States intends to deploy the missiles on time, according to the NATO decision. Both Departments acknowledge that missiles initially deployed may require some subsequent modification or correction, but consider it of overriding importance for the United States to meet its commitment to have the missiles in place, as scheduled, even if they fall somewhat short of meeting all their performance requirements.

CONCLUSIONS

The Army's schedule for developing and producing the initial quantities of Pershing II missiles must be viewed as containing a high degree of concurrency. It is not unusual to find some concurrency in major weapon system programs, particularly, where an urgent need to deploy the system exists. However, programs with as much concurrency as is present in Pershing II generally require more time than is budgeted for proving their performance and reliability before they enter production.

While considerable subsystem and component testing has not surfaced any significant problems with Pershing II, experience with other weapon systems has shown that integrated testing of the entire system often brings out shortcomings which could not be foreseen when the components were tested by themselves. The limited number of live firings held so far do not appear sufficient to indicate whether the system will be able to meet all its performance objectives by the scheduled initial deployment date.

As with Pershing II, the Ground Launched Cruise Missile still contains many critical unknown factors. The heart of the system, its terrain-following guidance, must still be demonstrated in a realistic operational environment. The Air Launched Cruise Missile test results, as they apply to the ground launched missile, are cause for concern and indicate that considerable progress must still be made in perfecting the cruise missile to achieve the desired capability and reliability.

The recent slip in the cruise missile's test schedule raises further concerns about the program. The severity of the problems and how quickly they can be resolved will determine whether the Air Force can begin the initial deployment schedule with a fully operational system.

Due to the understandable importance placed on meeting the deployment commitments, there is obviously added pressure to resolve remaining critical performance deficiencies before they are to begin deployment. To become involved in modifications after deployment could result in considerable cost. Defense is confident the missiles will meet their performance objectives. However, the two programs bear close watching to assure that they perform satisfactorily before beginning deployment.

RECOMMENDATION

The successful deployment of Pershing II and the Ground Launched Cruise Missile greatly concerns the Congress, particularly, the Committees on Appropriations and Armed Services and the Committees which deal with foreign affairs. GAO, therefore, recommends that the Secretaries of State and Defense include in their annual presentations before the appropriate committees, and more frequently if critical events occur, details on the progress made towards modernizing and deployment of the theater nuclear weapons in the context of the December 12, 1979, NATO decision.

AGENCY COMMENTS

In discussions with the Department of Defense officials associated with the management of the Pershing II and Ground Launched Cruise Missile programs and with officials of the Department of State's Bureau of Political-Military Affairs, they stated that they agreed with GAO's recommendation.

However, in both their oral and written comments, the Department of State said the report did not sufficiently emphasize the importance of the unanimous decision by the NATO ministers to modernize the theater nuclear forces after a prolonged effort to secure such agreement. The Department of State believes this decision, and the resolve to press ahead with modernizing, were responsible for bringing the Soviets to the negotiating table at Geneva. State Department officials are satisfied that good progress is being made in the three countries--the United Kingdom, the Federal Republic of Germany, and Italy--that have already begun to implement the NATO ministerial decision.

In its written comments, the Department of Defense does not agree that the degree of concurrency in the Pershing II program is high. Defense officials believe all critical testing of Pershing II will have been completed before the production decision. They have stated that program risks will be further reduced by beginning production at a low level until testing is completed. GAO adheres to its position, however, that results available from the active flight tests to be held before the production decision will be too limited to permit a proper assessment of the system's readiness for production.

Defense officials also believe that data provided by large numbers of Sea Launched Cruise Missile flight tests in a configuration closely corresponding to the Ground Launched Cruise Missile will be useful in assessing the latter's capability in all important areas before it is deployed. Defense officials said tests are continuing to address problems of establishing proper flight levels to minimize detection and problems with terrain contour mapping guidance, which were disclosed in earlier tests.

REVIEW OF AIR FORCE'S NEXT GENERATION TRAINER AIRCRAFT PROGRAM

In your March 13, 1980, letter, you asked us to review Air Force actions leading toward procurement of a next generation trainer aircraft for the primary phase of its two-phased undergraduate pilot training program. You submitted questions which had been provided to you by Congressman Jim Lloyd. (See app. I.) The questions concerned the capability of the Navy T-34C aircraft to perform the primary phase mission, the life cycle costs of the T-34C compared to alternative aircraft, and the extent to which the Air Force is complying with Office of Management and Budget (OMB) Circular A-109 and allowing consideration of the T-34C. You also provided the questions to the Air Force.

In August 1980 the Air Force completed its response. According to agreements made with your office, we reviewed and are commenting on the Air Force's response. The results of our review are discussed in detail in appendix II. In summary, we found that:

--The T-34C could be used as the Air Force's primary phase trainer. However, since the T-34C does not perform as well as the current primary trainer or well enough to meet stated requirements for the next generation trainer, its use could result in either additional flying hours in the primary and basic phases or lower undergraduate pilot training standards with additional training hours required in operational aircraft. Further, using the T-34C rather than an aircraft meeting the next generation trainer requirements could result in a larger number of training flight cancellations due to weather, increased air congestion problems, and greater use of auxiliary airports.

--The Navy is still buying T-34C aircraft for use as its primary phase trainer. Navy officials said that the T-34C has satisfactorily fulfilled the Navy's primary trainer aircraft requirements.

--The Air Force's life cycle cost comparison, which was prepared by a consultant, showed the T-34C was the least costly alternative if only the primary phase were considered. However, the comparison showed that it is the most costly if the total undergraduate pilot training program were considered. Our evaluation showed that some costs associated with using the T-34C aircraft were not included in the life cycle cost comparison. Also, some of the estimated costs in the comparison were based on contractor proposals and could not be substantiated.

--Air Force requirements and actions which effectively eliminated the T-34C from consideration in the program are not, in our opinion, consistent with OMB Circular A-109. We believe industry should have been as free to propose the T-34C as any other alternative aircraft. Congressional direction in August 1980, however, requested that the program be restructured to include consideration of the T-34C. Air Force officials are now taking action to comply with this direction. It should be noted that Air Force actions otherwise generally appear to be consistent with A-109. Its actions have resulted in competition--an important A-109 objective.

--The Air Force is performing a durability and damage tolerance analysis of the T-37B airframe to determine what modifications would be required to extend its service life to 25,000 hours. Analysis results are expected in May 1981. Extending the T-37B service life would not eliminate other T-37B deficiencies, such as excessive fuel consumption, noisy engines, outdated avionics, limited range, and lack of cockpit pressurization, but could result in the lowest initial investment for satisfying the requirement. Although the service life could be extended, the number of available T-37B aircraft will not be sufficient to meet projected pilot production rates beyond 1987.

Five contractors completed concept exploration studies for a next generation trainer in October 1980. The primary objective of the studies was to determine the lowest life cycle cost approach to maintaining the Air Force's pilot training capability. Each contractor selected an alternative aircraft, performed tradeoff studies, and prepared a life cycle cost estimate for the proposed alternative. The Air Force completed its evaluation of the contractors' studies in December 1980. This was completed too late for us to assess their evaluation. The Air Force plans to solicit proposals for full-scale development from the five concept exploration study contractors. These proposals, as well as acquisition of the T-34C and a service life extension of the T-37B, will be evaluated by the Air Force to determine which alternative would be the most cost-effective solution to the primary trainer needs.

We interviewed officials at the Office of the Secretary of Defense, Air Force Headquarters, Navy Headquarters, and Naval Air Systems Command in Washington, D.C.; Air Training Command, Randolph Air Force Base, Texas; and Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. Using documents and other information supplied, we analyzed Air Force data regarding the need for a new trainer aircraft, compared the operating capabilities of the T-34C and the T-37B aircraft with the requirements for a new trainer aircraft, evaluated the Air Force's efforts to comply with OMB Circular A-109 during the acquisition of a new trainer aircraft, and analyzed the Air Force procedures for issuing the request for proposal for the concept exploration studies of the next generation trainer. We also discussed the Air Force's implementation of OMB Circular A-109 with OMB officials. We did not evaluate the effectiveness of the current undergraduate pilot training program. As arranged with your office, we submitted a draft of this report to Department of Defense officials for their review. We did not request official comments. High level officials associated with the management of the program reviewed the draft to determine whether it was accurate and complete, and they agreed with its content.

AIR FORCE AND NAVY PLANS TO ACQUIRE TRAINER AIRCRAFT

Both the Air Force and Navy are planning to buy trainer aircraft to replace existing aircraft which are nearing the end of their service life. The Air Force is planning to acquire the Next Generation Trainer (NGT) for the first phase of its undergraduate pilot training and the Navy is planning to buy the Undergraduate Jet Flight Training System (VTXTS).

In addition, the Air Force is planning to acquire (1) a tanker-transport-bomber trainer aircraft if a proposed major change in its undergraduate pilot training program is implemented and (2) a companion trainer aircraft which would provide a less expensive alternative for part of B-52 aircrew training. Each aircraft is to be used for a different training mission.

Justification for acquisition of the aircraft is based, in part, on the need to reduce fuel and other operating costs and to improve training program effectiveness. Total program cost estimates are not available, but these programs are expected to cost several billion dollars.

AIR FORCE AND NAVY UNDERGRADUATE PILOT TRAINING DIFFER

Although many skills taught in Air Force and Navy pilot training are similar, the services conduct separate undergraduate programs and use different aircraft, concepts, and methods. Under the Air Force's generalized approach, all students receive the same training and fly the same aircraft. Under the Navy's specialized approach, student pilots initially receive a common training segment and then receive additional undergraduate pilot training in specific types of aircraft for specific missions. Upon graduation, pilots in both services are assigned to operational units where they receive additional training in their assigned aircraft.

COMPLIANCE WITH OFFICE OF MANAGEMENT AND BUDGET CIRCULAR A-109

GAO found that, with one exception, NGT and VTXTS acquisition programs were generally being conducted in accordance with the Office of Management and Budget Circular A-109. The exception is that the request for proposals/quotations for each program contained restrictions which effectively precluded consideration of potential alternative solutions to the mission need. Of particular concern, the Air Force's request for proposals effectively excluded the T-34C aircraft which the Navy is currently using for similar training. As a result of congressional direction in December 1980, however, the Air Force is now planning to consider the T-34C as an alternative solution to its NGT requirement.

Specific actions taken to comply with Circular A-109 include

--expressing needs in mission terms;

--maintaining competition between different design concepts;

--conducting cost, schedule, and performance trade-off studies;

--tailoring acquisition strategy for each system;

--estimating life cycle costs; and

--designating a program manager.

NGT AND VTXTS

Separate Mission Element Need Statements for the two programs were approved in June 1979. Since then, both services have awarded competitive contracts for system design concepts. Five contractors completed conceptual studies of the Air Force requirement for a primary phase trainer aircraft in October 1980. The Navy awarded six contracts in August 1980 to study possible VTXTS concepts.

Defense Systems Acquisition Review Council evaluations are scheduled in both programs. The Air Force anticipates a Council evaluation of the NGT program before the award of development contract to a single contractor in late 1981. The Navy's plans provide for a Council evaluation before awarding two or three demonstration and validation contracts in the fall of 1981.

Congressional interest and direction have been toward common aircraft for both the primary and advanced phases of the Navy and Air Force undergraduate pilot training programs. Early Air Force and Navy actions in the NGT and VTXTS programs appeared to be directed toward consideration of common aircraft, although it was recognized that actual use of common aircraft would probably not take place for many years. This condition exists because the Navy's T-34C, which corresponds to the NGT, and the Air Force's T-38, which corresponds to the VTXTS aircraft, could remain in service use through the 1990s.

The Air Force now believes, however, that--apart from consideration being given to the T-34C for its primary undergraduate pilot training phase--there is little likelihood of common trainer aircraft being used. Officials said that the requirements to replace current Air Force T-38 and Navy T-34C trainer aircraft may be approved several years after the projected production of Air Force NGT and Navy trainer aircraft is (designated VTX) completed. They also said that differences between Navy and Air Force flight training programs might preclude the development of common aircraft suitable for both services. Furthermore, they said that requirements for a replacement of the Air Force's basic phase trainer--the T-38--have not been identified and may differ significantly from the Navy's VTX aircraft.

A key Navy official stated in February 1981 that, when the T-34C is replaced, the Air Force's primary trainer would be considered. Its selection would not be certain, however, because the decision should be so far in the future that more cost-effective alternatives may be available.

TANKER-TRANSPORT-BOMBER TRAINER AIRCRAFT

The Air Force plans to specialize its pilot training program. All student pilots will receive the same training during the initial phase and then be divided into two groups. About 40 to 50 percent of the students would be taught skills to be used in fighter, attack, or reconnaissance aircraft while the other 50 to 60 percent would be taught skills to be used in tanker, transport, or bomber aircraft. The Air Force estimates this would save $65.5 million and 30.3 million gallons of fuel annually when compared to the present training program. It also believes specialized training will maximize the effectiveness of pilot training and produce a higher quality pilot. Before specialized training can be implemented, a tanker-transport-bomber trainer aircraft must be acquired.

COMPANION TRAINER AIRCRAFT

The companion trainer would be used by the Strategic Air Command to maintain and enhance training of all B-52 aircraft crews. It would be a small, relatively inexpensive, fuel efficient, business-type aircraft with avionics equipment similar to the B-52. The aircraft along with a weapon system trainer (simulator) would augment B-52 flight training and reduce the number of B-52 flying hours. This would reduce operating costs and fuel consumption.

During fiscal year 1981, the Air Force plans to test the viability of training in a companion trainer aircraft. The transferability and the value of companion training are two key factors to be evaluated. Because of differences in equipment on the various B-52 models, the anticipated training is expected to be less effective for crews of B-52D aircraft than for B-52G and B-52H aircraft. The Air Force plans, however, to exclude B-52D crews (about 25 percent of the B-52 force) from the fiscal year 1981 testing.

Air Force officials recognize that careful consideration of safety factors is necessary since the pilot and copilot would be qualified in both the B-52 and the companion trainer aircraft. Accordingly, the Air Force plans to also evaluate the effects of dual qualification on pilot performance, including possible negative effects, during the first 6 months of the testing.

RECOMMENDATIONS

In view of the congressional interest in common trainer aircraft for comparable phases of the Navy and Air Force undergraduate pilot training programs and the apparent decrease in the likelihood of common trainer aircraft being used, the Congress should explore the matter further with Defense. The objectives would be to determine whether:

--Defense has adequately complied with congressional direction regarding common aircraft.

--The apparent decrease in support, primarily by the Air Force, for common aircraft is warranted.

--The Air Force plans for consideration of the T-34C aircraft meet the congressional intent, as expressed in August 1980 by the Armed Services Committees.

The Secretary of Defense should modify the Companion Trainer Aircraft viability testing to include B-52D crews to obtain actual data on applicability of the training to all crews.

GAO did not request official comments on this report because of the tight reporting deadline. Instead, a draft of this report was discussed with high level officials associated with management of the program to assure that the report is complete and accurate. Their points of view are included where they differ with GAO's.

LISTING OF OTHER RELATED REPORTS ISSUED FROM MARCH 7, 1980, THROUGH MARCH 31, 1981

Report title	Report number	Report date
Is a Reassessment Needed of the Navy's Ability to Conduct Carrier Operations in High-Threat Areas? (SECRET)	C-PSAD-80-8	3/7/80
Space Defense Systems Program Issues and Status (SECRET)	C-PSAD-80-10	3/17/80
Serious Problems in the Offensive Capability of U.S. Surface Ships in Engaging Enemy Surface Ships (SECRET)	C-PSAD-80-25	5/9/80
DOD Information Provided to the Congress on Major Systems Could Be More Complete and Useful (SECRET)	PSAD-80-24	5/9/80
"SARs"--Defense Department Reports That Should Provide More Information to the Congress	PSAD-80-37	5/9/80
Is the Joint Air Force/Navy Alternate Engine Program Workable? GAO Thinks Not as Presently Structured	PSAD-80-40	5/9/80
The High Altitude, High Speed Target Program Should Either Be Modified to Realistically Simulate the Threat or Be Killed	PSAD-80-52	6/2/80
Army Procurement of 10kW, 60Hz Gas Turbine Generators is Becoming Even More Questionable Due to Rising Fuel Costs	PSAD-80-54	6/2/80
Issues Identified in 21 Recently Published Major Weapon System Reports	PSAD-80-43	6/12/80

Report title	Report number	Report date
Air Force Justification for Storing Its Advanced Medium Short Takeoff and Landing Prototype Aircraft	PSAD-80-56	6/16/80
Implications of Highly Sophisticated Weapon Systems on Military Capabilities	PSAD-80-61	6/30/80
Performance of Wilshal Corporation's Sonar System for Detecting Waterborne Intruders Does Not Meet the Department of Defense's Requirements	PSAD-80-63	7/2/80
Testing Under Highly Favorable Conditions Precludes Assessing GBU/15 Bombs Capability in a Combat Environment (SECRET)	C-PSAD-80-26	7/11/80
DOD Should Determine Cost and Operational Effectiveness of Helicopter In-Flight Escape Systems	PSAD-80-65	7/14/80
Concerns Which Should Be Considered in Evaluating the Patriot Air Defense Systems' Readiness for Production (SECRET)	C-PSAD-80-27	7/31/80
Cost Estimates for U.S. and Canadian F/A-18 Strike Fighters	PSAD-80-74	8/19/80
Evaluation of EF-111A Extended Development and Full-Scale Production Decision	PSAD-80-71	8/27/80
Building an Effective Antiarmor Capability in NATO (SECRET)	C-PSAD-80-28	9/16/80
Are Management Problems in the Acquisition of Aircraft Gas Turbine Engines Being Corrected?	PSAD-80-72	9/30/80

Report title	Report number	Report date
Review of Selected Negotiated Contracts Under the F-16 Multinational Aircraft Program	PSAD-81-3	10/7/80
The Department of Defense Should Determine the Cost Effectiveness of the Gator Mine System	PSAD-81-13	10/24/80
Defense's Overall Master Plan for Air Defense Should Consider Certain Issues in Its Development	PSAD-81-15	12/5/80
Effectiveness of U.S. Forces Can Be Increased Through Improved Weapon System Design	PSAD-81-17	1/29/81
Recommendations to Improve Defense Reporting on Weapon Systems	MASAD-81-7	3/2/81
The Army's Battery Computer System	MASAD-81-18	3/6/81
Questionable Need For Product Improvements to the Army's VULCAN Air Defense System	MASAD-81-21	3/16/81
Financial Status of Major Federal Acquisitions September 30, 1980	MASAD-81-13	3/23/81
Status of Army Efforts Concerning a Rotary Wing Escape System	MASAD-81-23	3/23/81
Reliability and Maintainability Requirements Need More Emphasis	MASAD-81-25	3/31/81

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